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Organizing the *South: Railroads, Plantations, and War.

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ORGANIZING THE SOUTH: RAILROADS, PLANTATIONS, AND WAR

A Dissertation

**Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy**

in

The Department of History

by

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B. S., Oklahoma State University, 1987

M. A., Southwest Texas State University, 1992

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ABSTRACT

This work examines the emergence of organizational and bureaucratic ideas in the nineteenth-century South. It shows that organizational thinking took root in the antebellum South and grew during the Civil War. Many Southerners accepted the modern precepts of time, system, and bureaucratic control. They created of modern view of the world while incorporating slavery within this outlook. These same organizational ideals helped create a New South.

The first section of this work examines how southern railroad managers introduced modern bureaucratic structures into their operations. At the same time, they incorporated slavery within this modern corporate structure. The second section examines the acceptance of modern ideas of organization, system, control, and technology by southern planters. Southern reformers transformed organizational ideals into a unique vision of modernization based on agriculture and slave labor. Agricultural reform, educational reform, and commercial conventions became the clearest manifestations of these new organizational ideals.

The third section of this dissertation studies the growth of organizational and bureaucratic ideas during the Civil War. Southern

railroads and the Confederate Ordnance Department reveal the failure and success respectively of organizational ideas during the war. Under the strain of war, southern railroads' bureaucratic structures collapsed. However, the Confederate Ordnance Department represented the greatest success the Confederacy had in organizing for war. The Ordnance Department incorporated the latest ideas of system, uniformity, and control associated with the American System of Manufacturing.

The final section of this study examines how the organizational ideas that emerged during the antebellum period and during the war provided the framework for creating a New South. Railroad managers, agricultural reformers, and former Confederate Ordnance officers, all played a role in this transformation. Railroad managers continued to improve bureaucratic operations and acted upon the lessons they learned from the war. Many Confederate Ordnance officers became academics after the war and played a significant role in higher education reform. Agricultural reformers continued to preach the need for system, control and organization in southern agriculture. Organizational and bureaucratic ideas associated with railroads, plantations, and war provided the foundations for a New South.

INTRODUCTION

A historical debate has occurred in the last thirty years over modernization in the nineteenth-century South. Did the South accept the modern tenets associated with the industrializing North or did it reject new technologies and managerial ideas? In other words, was the South capitalist or pre-capitalist? Eugene Genovese asserted in the 1960s that the antebellum South, with its slave-based society, remained noncapitalist in an increasingly free-labor, wage-labor, capitalist world. He has since moderated his views and backed away from significant parts of his argument. Nevertheless, the questions he raised originally have continued to interest historians, some of whom have shown that planters were capitalistic. Slavery, they argue, did not preclude a modernist interest in economic rationalization.¹ This study's findings support this revisionist conception of the Old South.

¹Eugene D. Genovese, The Political Economy of Slavery: Studies in the Economy and Society of the Slave South (New York: Pantheon Books, 1965); Eugene D. Genovese, The Slaveholders' Dilemma: Freedom and Progress in Southern Conservative Thought, 1820-1860 (Columbia: University of South Carolina Press, 1992); James Oakes, The Ruling Race: A History of American Slaveholders (New York: Alfred A. Knopf, 1982); Mark M. Smith, Mastered by the Clock: Time, Slavery, and Freedom in the American South (Chapel Hill: University of North Carolina Press, 1997); Laurence Shore, Southern Capitalists: The Ideological Leadership of an Elite, 1832-1885 (Chapel Hill: University of North Carolina Press, 1986);

One manifestation of capitalism in the nineteenth century was the emergence of new organizational ideas and bureaucratic structures in concert with industrialization. Railroads and factories required bureaucratic structures in order to control time, labor, and technology. Historians have argued that in the nineteenth century innovations in industrial production, transportation, and communication brought about a "control revolution." This revolution created the need for system, uniformity, and bureaucratic structures. At the same time, an organizational mentality or *Zeitgeist* arose as individuals created new organizations to protect their interests. Indeed, organizational thinking became part and parcel of the spirit of the times and a central component of the pursuit of progress and modernity.²

This development of organizational thinking raises important questions with respect to the South. Did the South embrace the new organizational and bureaucratic ideas associated with industrialization? And if so, where and when did these organizational ideas emerge? These

J. Mills Thornton III, Politics and Power in a Slave Society: Alabama, 1800-1860 (Baton Rouge: Louisiana State University Press, 1978); Lacy K. Ford, Jr., Origins of Southern Radicalism: The South Carolina Upcountry, 1800-1860 (New York: Oxford University Press, 1988).

²Alfred D. Chandler, The Visible Hand: The Managerial Revolution in American Business (Cambridge: Harvard University Press, 1977); James R. Beniger, The Control Revolution: Technological and Economic Origins of the Information Society (Cambridge: Harvard University Press, 1986); David A. Hounshell, From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States (Baltimore: The Johns Hopkins University Press, 1984); Louis Galambos, "Technology, Political Economy and Professionalization: Central Themes of the Organizational Synthesis," Business History Review 57 (4): 471-493.

questions are the central concern of this dissertation, which examines the development of an organizational mentality in the South on its railroads, plantations, and during the Civil War. Indeed, the emergence of a New South evolved from the ideas first introduced into Southern society during the antebellum decades and during the war.

The railroad industry provides a logical point of departure for an examination of this organizational transformation within the South. As Alfred Chandler demonstrated in his work, The Visible Hand, the railroad industry of the 1850s became the first big business to require a large-scale bureaucratic structure to coordinate its movements. This was as much the case in the South as in the North. The first section of this work examines how Southern railroad managers adopted and used modern bureaucratic structures. They put in place management hierarchies, as well as other bureaucratic structures, to maintain system and control, over their operations. At the same time, they incorporated slavery into this modern corporate structure. For those who owned and managed southern railroads, economic progress and slavery went hand-in-hand.

The second section of this work examines the acceptance of modern ideas of organization, system, control, and technology by southern planters. A study of southern agricultural journals demonstrates that a significant number of southerners accepted and tried to incorporate bureaucratic structures and organizational ideals in their agricultural practices. Southern reformers transformed new ideas of system, technology, organization, and

control into a unique vision of modernization based on agriculture and slave labor. Moreover, they sought to apply organizational structures to southern society. Agricultural reform, educational reform, and commercial conventions, especially during the 1850s, were manifestations of these new organizational ideals.

The South moved toward a more organized and bureaucratized society during the 1850s. The Civil War intensified these modern, organizational changes. In order to fight an industrialized North, the South had to transform its agricultural society into a war-fighting machine. The history of southern railroads and the Confederate Ordnance Department reveal the failure and success of the application of organizational ideas during the war. Under the strain of war, the bureaucratic structures of southern railroads collapsed. This section examines why the lines failed and the lessons learned by southern railroad managers--lessons that they would apply to railroad management after the war. The Confederate Ordnance Department epitomized the greatest success the Confederacy had in organizing for war. The Ordnance Department incorporated the latest ideas of system, uniformity, and control associated with the American System of Manufacturing. When it came to equipping its armies with ammunition and gunpowder, modern bureaucratic principles allowed the South to wage a long and destructive war. Southerners, who, after the war, strove to create a New South, did not fail to grasp these lessons.

The final section of this study examines how the organizational ideas that emerged during the antebellum period and during the war provided the framework for creating a New South. Many southerners argued that a New South could be created with the adoption of bureaucratic and organizational structures. Railroad managers, agricultural reformers, and Confederate Ordnance officers, all played a role in attempting to bring about this economic transformation. After the war, railroad managers continued to improve bureaucratic operations and acted upon the lessons they learned from the war. They forged economic links between the New South and the North through consolidation and new forms of traffic agreements. Many Confederate Ordnance officers became academics after the war and played a significant role in transforming higher education. From their universities, they taught a new generation of southerners the virtues of system, uniformity, and bureaucratic control. They also changed the university curriculum so that it stressed expertise in technology, science, and engineering. At the same time, agricultural reformers continued to preach the need for system and control in southern agriculture. They pushed for the adoption of new technology, fertilizer, labor-saving machinery, and a modern view of time management. Also, farmers began to organize in order to assert control over the market. This organizational mentality would assume concrete form first with the Patrons of Husbandry and, later, with the Farmers' Alliance.

This study reevaluates the South from a new perspective. It shows that organizational thinking and bureaucratic structures took root in the antebellum South and intensified during the Civil War. To a surprisingly large degree, men of property and power in the Old South had accepted the modern precepts of time, system, and bureaucratic control. From this acceptance, they created of modern view of the world, while incorporating slavery within this outlook. With the destruction of slavery, a New South grew on the ideas associated with railroads, plantations, and war.

CHAPTER 1

"THE VISIBLE HAND" IN THE ANTEBELLUM SOUTH: SOUTHERN RAILROAD MANAGEMENT, 1840-1860

In the summer of 1852, Isham Howze, a Mississippi farmer, wrote in his diary: "While sitting here, I can hear the puffing, and rumbling, and whistling of the railroad locomotive and cars, for the first time." The following November, he added enthusiastically, "I can hear the steam whistle—the railroad cars are moving. What improvements in science and art!"¹ Howze lived near one of the South's largest railroads, the Memphis and Charleston, and he understood that the world was changing around him. Indeed, when railroads began to rumble through the South, they brought more than a new source of transportation; they carried with them men who had new conceptions of time, technology, control, and organization.² Southerners did not ignore these changes. Rather, they

¹Isham Howze Journal, August 2, 1852 and November 26, 1852, Box 1, Folder 5, in Isham Howze Family Papers, Mississippi Department of Archives and History, Jackson Mississippi.

²See especially, Alfred D. Chandler, The Visible Hand: The Managerial Revolution in American Business (Cambridge: Harvard University Press, 1977); James R. Beniger, The Control Revolution: Technological and Economic Origins of the Information Society (Cambridge:

embraced modernization, new organizational ideas, and strove to incorporate them into their slave society.³

Modern bureaucratic structures that incorporated the ideas of system, uniformity, and control, developed during the ante-bellum period from the management techniques adopted by the railroads and by the military. The American System of Manufacturing and large-scale railroads emerged concomitantly and changed the structure of the economy dramatically. From both of these sources emerged the principles and methods of what would later comprise the bureaucratic system of corporate management.

Harvard University Press, 1986); Thomas C. Cochran, Railroad Leaders, 1845-1890: The Business Mind in Action (New York: Russell & Russell, 1965); Mark M. Smith, Mastered by the Clock: Time, Slavery, and Freedom in the American South (Chapel Hill: The University of North Carolina Press, 1997), 69-89.

³For important works on southern railroads see John F. Stover, The Railroads of the South, 1865-1900: A Study in Finance and Control (Chapel Hill: The University of North Carolina Press, 1955); Maury Klein, The Great Richmond Terminal: A Study in Businessmen and Business Strategy (Charlottesville: University of Virginia Press, 1970); Allen W. Trelease, The North Carolina Railroad, 1849-1871, and the Modernization of North Carolina (Chapel Hill: The University of North Carolina Press, 1991); Kenneth W. Noe, Southwest Virginia's Railroad: Modernization and the Sectional Crisis (Urbana: University of Illinois Press, 1994); Scott Reynolds Nelson, "Public Fictions: The Southern Railway and the Construction of the South, 1848-1885," (Ph.D. diss., University of North Carolina, 1994); George R. Taylor and Irene D. Neu, The American Railroad Network, 1861-1890 (Cambridge: Harvard University Press, 1956); U. B. Phillips, A History of Transportation in the Eastern Cotton Belt to 1860 (New York, 1908); Robert C. Black III, The Railroads of the Confederacy (Chapel Hill: University of North Carolina Press, 1952); Franz Anton Ritter Von Gerstner, Early American Railroads: Franz Anton Ritter von Gerstner's Die innern Communicationen (1842-1843) ed. Frederick C. Gamst, trans. David J. Diephouse and John C. Decker (Stanford: Stanford University Press, 1997);

The influence of the railroad and the American System of Manufacturing on the North has been studied comprehensively.⁴

The antebellum economy changed slowly from one based on merchant capitalism with specialized enterprises of commerce to one based on large-scale bureaucratic structures. The Civil War served as a catalyst for the completion of this transformation.⁵ Until the 1840s, transportation by way of turnpikes, canal boats, steam boats, and trans-Atlantic packet ships provided a loose organization and regular routes. These types of enterprises required some specialized management but not a large-scale bureaucratic system. A merchant, through family connections, could control most aspects of his trade. Transactions of merchants followed simple bookkeeping methods. Even investment in turnpikes, canal boats, and steamboats required only a few partners and did not change merchant

Albro Martin, Railroads Triumphant: The Growth, Rejection, and Rebirth of a Vital American Force (New York: Oxford University Press, 1992).

⁴See especially, Chandler, The Visible Hand; David A. Hounshell, From the American System to Mass Production. 1800-1932: The Development of Manufacturing Technology in the United States (Baltimore: The Johns Hopkins University Press, 1984); James R. Beniger, The Control Revolution: JoAnne Yates, Control through Communication: The Rise of System in American Management (Baltimore: The Johns Hopkins University Press, 1989).

⁵James L. Huston, "The American Revolutionaries, the Political Economy of Aristocracy, and the American Concept of Wealth, 1765-1900," The American Historical Review 98 (October 1993): 1098-1105.

capitalism dramatically. In addition, the slow speed of steamboats and canal boats needed little scheduling or control.⁶

Before the 1840s, manufacturing also followed traditional patterns. Few enterprises required a complex internal organization or provided large-scale production. Only in textiles, such as the Lowell factories that adopted machinery, did this type of production emerge before to the 1840s. The organization of these mills, however, did not require complex bureaucratic structures or a great deal of skilled labor. For a long time, textile mill managers followed "traditional ways," and "organizational innovation" came slowly.⁷

In the 1830s, railroads tried to conduct their operations through the traditional 19th-century management style of the contract system. This non-bureaucratic form of organization used small companies to run specific operations. However, for a large railroad, this system of management did not work effectively. The managers of the early railroads encountered significant problems. Wrecks occurred quite frequently. The first large-scale railroad, the Western, experienced several collisions in 1841 that killed both employees and passengers and horrified the public. In response, northern railroad journals called for managerial reform in order to make railroad

⁶Chandler, The Visible Hand, 36-49.

⁷Ibid., 58-68; See also Anthony F. C. Wallace, Rockdale: The Growth of an American Village in the Early Industrial Revolution (New York: W. W. Norton, 1980).

travel safer and more reliable.⁸ Accidents proved the major stimulus for better management techniques and a more efficient system of railroad operations.⁹ Railroad managers in both the North and the South read these railroad journals, and they played a significant role in expanding the adoption of new bureaucratic structures as well as the professionalization of railroad management.¹⁰ Many railroad managers came to the conclusion that bureaucratic structures allowed for more control, managerial authority, and discipline.¹¹

In 1851, the American Railway Times made the point that railroad workers needed experience and training to "insure safety and general efficiency of service regardless of cost. This is no place for niggardly economy. . . . Five or ten dollars saved per month on a switchman's wages makes a poor show for the thousands lost by the man's inefficiency." Railroad managers asserted that investment in safety features such as state

⁸Chandler, The Visible Hand, 96-97.

⁹"Reform our Railroad System," American Railway Times, v. 5, 7 July 1853.

¹⁰T. J. Sumner, engineer for the Charlotte and South Carolina, reported that he studied the Railway Times, especially the operating expenses of other railroads. Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company, at their Twelfth Annual Meeting (Columbia, S.C., 1860), 15.

¹¹Walter Licht, Working for the Railroad: The Organization of Work in the Nineteenth Century (Princeton: Princeton University Press, 1983), 19-24.

of the art brakes, couplings, and switches not only saved money but also saved lives.¹²

In addition to better construction and technology, railroad managers wanted administrative reform, especially systematic rules and regulations. "Basically," a writer for the American Railway Times argued in 1851, "rules to stay on schedule and not leave a station late" went unheeded. This lack of rigid time schedules resulted in many train collisions. The writer maintained that "discipline" should be "enforced on every railway in the country. There can be no safety without it." The article outlined 47 rules, regulations, and procedures that railroads should follow. Furthermore, to help coordination of movement, railroads required an "organized system of railroad communication." In another article, a contributor contended that railroads needed a "system" that introduced "discipline, and . . . economy."¹³

By the mid-1850s, railroad managers had addressed many of these problems with the introduction of bureaucratic structures and the use of the telegraph. In 1847, the managers of Baltimore and Ohio Railroad created a new plan entitled Organization of the Services of the Baltimore and Ohio R. Road under the Proposed New System of Management. This plan tried to "systematize its operations" by dividing the road into two

¹²"Railway Accidents," American Railway Times 24 July 1851.

¹³"Railway Regulations," *Ibid.*, 13 November 1851; "Railway Management," *Ibid.*, 9 December 1852.

departments: "The Working of the Road" and "The Collection and Disbursement of the Revenue."¹⁴

Introduction of bureaucratic structures brought significant improvement to railroad operations. In an 1854 report on the Erie Railroad, a reporter found that the company had a "triumph of principle and good management over selfishness and insubordination." Rather than chaos, the writer observed a "rigid system of accountability of agents" and workers. "Formerly," the reporter stated, "the utmost confusion prevailed in this department, so much so, that in the greatest press of business, cars in perfect order have stood for months . . . without being put to the least service, and without its being known where they were." But with the introduction of management reforms, bureaucratic structures, and the telegraph, the general superintendent "can tell at any hour in the day, the precise location of every car and engine on the line of the road, and the duty it is performing."¹⁵

In an 1856 article, a reporter outlined the line-and-staff system on the Erie Railroad. The writer compared the many details in the management of a railroad to "a thick veil, a cloud, a fog," but claimed that a bureaucratic structure lifted the fog. The reporter discussed a new "chart or diagram, exhibiting the division of responsibility" for the management of the New

¹⁴Licht, Working for the Railroad, 13; Alfred D. Chandler, Jr., "The Railroads: Pioneers in Modern Corporate Management," Business History Review 39 (Spring 1965): 23.

¹⁵"Erie Railroad," American Railroad Journal 27 (September 2, 1854): 549; Chandler, The Visible Hand, 104.

York and Erie Railroad. "This chart, sketched by the superintendent . . . as an outline of the system . . . [is] an exact and faithful representation of the actual condition of the management." A total of 4,715 workers, "each of whom is represented in this chart by a circle . . . attached together by suitable stems, and connected finally through the superintendent." The writer saw that in this system "every man is distinctly entrusted with a certain department," and "by the aid of daily reports from the conductors and station agents . . . and of systematic division of the care and labor in every department . . . , the superintendent is enabled to return to the men carefully prepared monthly reports." In this way, the railroad improved "the economy and efficiency of every department. . . ." ¹⁶ These management reforms fundamentally changed the nature of work for people employed by the railroads. Railroad rulebooks provided strict instructions that established standards of conduct, lines of authority, and guidelines for operations. Most tasks had "minutely drawn directives." Strict regulations against drinking and other activities became the norm on railroads. Men worked on precise schedules and had little say in the management of the line. ¹⁷

In order to run a large railroad, professional managers became essential. In 1850, the American Railroad Journal argued that the "railway"

¹⁶"The Responsibility of Railway Management," American Railway Times, 12 June 1856.

¹⁷Licht, Working for the Railroad, 43, 5, 81.

was "a distinct department of industry" that existed "without parallel in the history of industrial pursuits." Therefore, the journal asserted, railroad managers needed "more skill and experience" as well as a scientific and technical education. In other words, railroad management required salaried professionals who devoted all of their time, education, and energy to railroad administration. Scientific education, technical training, and professional status, the writer argued, ensured better management, more reliable service, and left "no room for accidents."¹⁸

Another railroad reformer contended that owners and the board of directors should not interfere with the daily management of a railroad because they did not understand the complex operations. "The Superintendents of the roads," the writer protested, "instead of being encouraged in carrying out their own plans, and in adopting a rigid system of supervision and accountability, are embarrassed and interfered with by the Directors who . . . assume the power and prerogatives which only properly and exclusively should belong to the Superintendents." Only with a separation of management from ownership could the superintendent control efficiently "not only monthly and weekly, but daily, all the details of the operating of the road. . . ."¹⁹

¹⁸"Qualifications for the Management of Railroads," American Railroad Journal, 23 (December 14, 1850): 790-791.

¹⁹"Personal Accountability in the Mgmt. of Railroads," American Railway Times, 1 May 1856.

Northern railroad management slowly evolved into a systematic organization that allowed for bureaucratic control. Railroads developed functional departments and management along geographical lines. Management followed a hierarchical chain of command based on line-and-staff organization. This system allowed for the division of responsibilities as well as control and communication feedback. Daily and monthly reports from each division produced statistics on miles run, operating expenses, and repairs. Detailed reports allowed for the introduction of cost accounting and greater efficiency of operations. Rules and regulations controlled and directed the actions of hundreds, if not thousands, of employees. Detailed instructions in case of emergencies, such as a train wreck, created standard operating procedures. Significantly, ownership and management became separate functions, and professional managers oversaw the operations of the company.²⁰

The ideas associated with northern railroad management also took hold in the South. Indeed, in many respects, railroad modernization in the South mirrored northern operations. Although most southern railroads were not as large as northern railroads, their managers struggled with the same problems and tried to implement the similar bureaucratic solutions. Railroads in the South--especially long lines--required the same system of management as northern railroads. Indeed, with the introduction of a new

²⁰Chandler, The Visible Hand, 96-106.

technology and trained professionals, the South went through the same modernization process as the North.

Isham Howze captured the spirit of the age with his excitement at the introduction of the railroad. Southerners, especially Whigs, heeded the new "Industrial Gospel" brought on by the transportation and industrial revolutions. They believed that technological progress, railroads, and economic growth would create a more orderly and efficient society. Southern journals and editorials remarked repeatedly on the power of steam and the railroad to transform the South. De Bow's Review, the leading southern industrial journal, proclaimed that "the revolution" commenced by the railroad "has been equaled by no other which history records. . . . It has diminished labour, destroyed space, lengthened time, and created a new world." The Southern Quarterly Review, an arts and science journal, advocated the building of railroads to promote commerce, industry, and "all sources of our genius and wealth." This promotion would be "propelled onward by the perfection of science . . . [and] the magnetic telegraph," and the "locomotive" would improve "civilization and intellectual life." The American Cotton Planter foresaw that the railroad had "the social, moral, and political . . . energy" to create a "modern civilization." Many southerners agreed with these assessments and viewed railroads as a key component in the modernization of the South.²¹

²¹ "Railway Systems and Projects in Europe and America," De Bow's Review 1 (January 1846): 21-22; "The History and Economy of Railroads,"

As the first large corporate entities, the railroads required new financial arrangements. For the most part, southerners built their own railroads. Local, county, and state conventions raised money from individual investors. These investors tended to be from urban areas and the economic leaders in their regions--planters, merchants, and lawyers. The arguments they used to entice investment centered on expanding the market, lowering freight costs, and increasing industry. The Charlotte and South Carolina Railroad's first convention, for example, stressed that investment in the line would open "up new sources of wealth, of

Southern Quarterly Review 13 (April 1848): 373; "Railroads," American Cotton Planter 1 (1853): 25-26; On the relationship between technology, industrial progress, and progressive ideology in the antebellum South see especially, Daniel Walker Howe, The Political Culture of the American Whigs (Chicago: The University of Chicago Press, 1979); Lawrence F. Kohl, The Politics of Individualism: Parties and the American Character in the Jacksonian Era (New York: Oxford University Press, 1989); John F. Kasson, Civilizing the Machine: Technology and Republican Values in America, 1776-1900 (New York: Penguin Books, 1976); J. Mills Thornton, Politics and Power in a Slave Society: Alabama, 1800-1860 (Baton Rouge: Louisiana State University Press, 1978); Lacy K. Ford, Jr., Origins of Southern Radicalism: The South Carolina Upcountry, 1800-1860 (Oxford: Oxford University Press, 1988); James Oakes, Slavery and Freedom: An Interpretation of the Old South (New York: Vintage Books, 1990); Laurence Shore, Southern Capitalists: The Ideological Leadership of an Elite, 1832-1885 (Chapel Hill: The University of North Carolina Press, 1986); Vicki Vaughn Johnson, The Men and the Vision of the Southern Commercial Conventions, 1845-1871 (Columbia: University of Missouri Press, 1992); Mary A. DeCredico, Patriotism for Profit: Georgia's Urban Entrepreneurs and the Confederate War Effort (Chapel Hill: The University of North Carolina Press, 1990); Tom Downey, "Riparian Rights and Manufacturing in Antebellum South Carolina: William Gregg and the Origins of the 'Industrial Mind,'" Journal of Southern History 65 (February 1999): 77-108; Paul F. Paskoff, "Invention and Culture in the Old South, 1790-1860," Unpublished paper delivered at Works-in-Progress Seminar, Louisiana State University, November 1991.

employment . . . [and] facilities of trade and general intercommunication.”²²

These conventions also pointed out that as railroads expanded the market, it would benefit both yeoman and planters alike. This argument for expansion helped build a general consensus in favor of railroad construction.²³

Individual investment, however, was not enough to build the railroads. During the antebellum period, southern states invested over \$81 million, and local governments contributed over \$55 million toward railroad construction. In all, the public sector contributed 55 percent to antebellum railroad construction in the South, much of it funded with long-term debt and bonds. Despite complaints about the dangers of using public funds for internal improvements, local and state governments saw each other as rivals for railroad links. The *Montgomery Advertiser*, for example, asserted in 1852 that the city was “surrounded by rivals and would-be rivals on all sides. Columbus in one direction, Selma in another, and Wetumpka is another.” Montgomery needed to develop railroad connections soon or the city faced the “danger of serious loss and injury to our growth and prosperity.” State governments also believed they needed to fund railroad

²²Proceedings of a Convention Respecting the Charlotte and South Carolina Rail Road. Held at Winnsboro', Fairfield District, S. C. (Columbia, S. C., 1847), 12-13.

²³Trelease, The North Carolina Railroad, 16-17; Bradley G. Bond, Political Culture in the Nineteenth-Century South: Mississippi, 1830-1900 (Baton Rouge: Louisiana State University, 1995), 8-10.

construction or they would fall behind other states economically. The Mobile and Ohio Railroad, for instance, constructed its line with city and state funds. The City of Mobile initially invested \$300,000 with a real estate tax, and the State of Alabama invested \$400,000 with government bonds. In addition, the railroad sold state-backed bonds on the European market. Most southern railroads financed their construction in similar ways, with government and private enterprise working together.²⁴

The building of railroads required not just money but technical expertise. Southern railroad companies quickly began to appreciate the need for experts to build their lines. In their first meeting, the directors of the Charlotte and South Carolina Railroad observed the need of "competent Engineers." They noted that "the want of knowledge which the Engineer alone possesses, disqualifies any one, however respectable, to claim for his mere opinions, that authority which should be the basis of decision."²⁵ A

²⁴William J. Cooper, Jr., and Thomas E. Terrill, The American South: A History v. 1 (New York: McGraw-Hill, Inc., 1991), 324; On public financing, see especially Milton S. Heath, "North American Railroads: Public Railroad Construction and the Development of Private Enterprise in the South before 1861," Journal of Economic History 10 (1950): 40-43, 46-48; Trelease, The North Carolina Railroad, 16-20; Klein, The Great Richmond Terminal, 8-11; Nelson, "Public Fictions," 9-25; "Internal Improvements," Advertiser and Gazette (Montgomery), 9 March 1852; Proceedings of the Eight Annual Meetings of the Stockholders of the Mobile and Ohio Railroad Company (Mobile, 1856), 3-4, 7, 10; Proceedings of the Ninth Annual . . . of Mobile and Ohio Railroad Company (Mobile, 1857), 4, 9; Proceedings of the Tenth Annual . . . of Mobile and Ohio Railroad Company (Mobile, 1858), 4-5.

²⁵Proceedings of a Convention Respecting the Charlotte and South Carolina Rail Road Held at Winnsboro, Fairfield District, S. C. (Columbia, S. C., 1847), 8.

civil engineer on the Mobile and Ohio Railroad noted in his diary the expertise required. "I must change," he wrote, "for the last 6 weeks or two months I have not studied as much as I ought. I am getting altogether too careless. If I don't look out I will lose what little Reputation I have been three or four years in building up."²⁶

Indeed, railroad construction included a myriad of engineering tasks. Physical geography played an important role in planning and building a line. The most important factors concerned a railroad's grade and curve. Engineers encountered steep grades, which necessitated a knowledge of physics and mathematics. The art of cutting, filling, and excavating the road required education and experience. M. B. Prichard, the chief engineer of the East Tennessee and Georgia Railroad, observed that the selection and building of a railroad took the "utmost care" and had to be based on an engineer's knowledge of the "prescribed limits of grade and curvature."²⁷

In addition, building railroad lines depended on proper organization of construction crews. Southern projects often involved complex divisional organizations. The Memphis and Charleston, for example, laid over 200

²⁶His studies included Civil Engineering by Dennis U. Mahan. Civil Engineer Diary, March 14 and March 15, 1854 in Civil Engineer, Mobile and Ohio Railroad, Diary December 14, 1853-December 31, 1854. Box 22, 7N, Range B, Section 1, Shelf A. Alabama Department of Archives and History, Montgomery, Alabama.

²⁷Martin, Railroads Triumphant, 253; Annual Report of the President and Directors of the East Tennessee & Georgia Railroad Company (Athens, Ga., 1852), 16.

miles of road. In order to work that amount of milage efficiently, the company divided the line into six divisions, each with its own supervisor. John Childe, the chief engineer of the Mobile and Ohio Railroad, commented on the importance of organization. "The first step," in construction, he observed, "was to arrange a system of operations," that provided "simultaneous and united action." Organizational control, he explained, required "a permanent organization of officers" that enabled "the Company to progress with judgement, economy and efficiency."²⁸

Besides grading and laying track, railroad companies built bridges, machine shops, and depots. M. B. Prichard proudly told stockholders that his railroad planned on constructing a "model bridge" over the Tennessee River. It would span 1,694 feet, supported by "10 piers and two abutments of first class cut stone masonry." He reported the building of "substantial and capacious Freight houses of brick and stone" as well as turn tables, hoisting platforms, and car shops. The architecture of these types of buildings often became quite elaborate. L. O. Reynolds ordered the Savannah depot made "on a scale suited to the magnitude of the enterprize." Engineers believed

²⁸Fifth Annual Report of the Board of Directors to the Stockholders in the Memphis and Charleston Railroad Company (Memphis, Tenn., 1855), 29; Proceedings of the Fourth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Company (Mobile, Ala., 1852), 3-4, 11.

that their works symbolized the system, uniformity, and progress of the age.²⁹

Southern railroads grew rapidly in the late 1840s and especially in the 1850s. In the decade before the Civil War, nearly 7,000 miles of track crossed the South out of 22,000 in the nation as a whole. Nevertheless, most southern railroads remained local in nature because they concentrated on the cotton market. By the late 1850s, though, the South had constructed several long haul roads. For instance, the Central of Georgia covered over 200 miles, distinguishing it as the longest railroad in the world in 1846. By the eve of the Civil War, the Mobile and Ohio had 469 miles of road. These long lines required a large number of locomotives and freight cars. The South Carolina Railroad, for example, controlled 849 cars of different types, the Western & Atlantic employed 746, and the Southwestern of Georgia 235 by 1860. As a result, southern railroads, much like their northern counterparts, struggled with questions of technology, system, and organization.³⁰

²⁹Annual Report of the President and Directors of the East Tennessee & Georgia Railroad Company (Athens, Tenn., 1853), 13 and (Athens, Tenn., 1855), 11; Second Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1838), 30; David F. Noble, The Religion of Technology: The Divinity of Man and the Spirit of Invention (New York: Alfred A. Knopf, 1998), 21-100; See also, Kasson, Civilizing the Machine.

³⁰Chandler, The Visible Hand, 79-121; Black, Railroads of the Confederacy, 2-3, 5, 21.

De Bow's Review understood the challenge and explained to its readers that railroads required technical and managerial expertise. "There is deplorable ignorance in the minds of intelligent commercial men," the journal reported, "as regards the value, the duties and the responsibilities of the engineer." Southern railroad investors did not give engineers the authority they needed to run a railroad efficiently, De Bow's complained, a remark that echoed many northern railroad journals. The boards of directors, the journal maintained, "taken as they are, for the most part, from the counting room, the plantation, or even the law bench, are not, nor ever could be, prepared to transact the business of the operative bureau without an engineer's training." Engineers, not the investors, the journal concluded, should control the labor, the operation, and the "discipline" of the road, because a well-run railroad required a "professional engineer," not an "ignorant and untried quack!"³¹

A South Carolina educational journal, The Self Instructor, also made the connection between engineering skill and railroad management. "The complicated operations of a railroad company are not unlike the strategic movements of an army. . . ." Therefore, the article continued, it behooved the South to arouse "public interest to see that the highest talent of the country be developed, especially in the engineer department of the mechanical art, for upon the wisdom of her railroad operations does much

³¹ "Rail-Road Administration at the South. The Civil Engineer," De Bow's Review 14 (February 1853): 146-151.

of the South's chance for direct trade and commercial independence rest."

In order to accomplish this training, the South had to "support our military schools as near as possible on the model of West Point, and there will be no want of mechanical talent and theoretical knowledge among our youth, to supply any demand we make."³²

De Bow's Review and the Self Instructor touched on an important point that the railroads required large-scale bureaucratic structures to coordinate their manpower and train movements. This development was as much the case in the South as in the North, as large southern railroads adopted new organizational structures and business techniques. Despite complaints that southern railroads lagged behind northern railroads in organization and technology, the South did attract experienced men to build and organize its railroad enterprise. For example, J. Edgar Thomson, a recognized leader in railroad management, who established the bureaucratic structure for the Pennsylvania Railroad in 1857, gained much of his experience on southern railroads. During the 1840s, Thomson served as the superintendent of transportation for the Georgia Railroad, where he

³²"Railroads," The Self Instructor: A Monthly Journal Devoted to Southern Education and to the Diffusion of a Knowledge of Resources and Power of the South, as represented by The Negro, The Rail and the Press 1 (November 1853): 39-40.

developed the rudimentary organizational structure he implemented on the Pennsylvania in 1857.³³

Thomson divided the Georgia Railroad into departments. He made the superintendent of transportation responsible for the "regular and safe transmission" of everything "sent by the road" and gave him "entire control" over all the railroad's departments. Under the transportation superintendent, Thomson had a superintendent of motive power, who managed the railroad's movements, a superintendent of the car factory, who oversaw the machine shops and repair of cars, and two maintenance officers who directed the upkeep of the road and managed the construction and maintenance crews. Thus, it was in the South, and not in the North, that Thomson first developed the incipient managerial hierarchy that historian Alfred Chandler considered the critical component in the development of a corporate bureaucracy.³⁴

Thomson did not act alone in trying to implement bureaucratic ideas on southern railroads. Other experts, usually in the new fields of

³³J. Edgar Thomson, "The Pennsylvania Rail Road Company. Organization for Conduction the Business of the Road. Adopted December 26, 1857" in The Railroads: Pioneers in Modern Management, Alfred D. Chandler, ed., (New York: Arno Press, 1979), 3; Chandler, The Visible Hand, 105-106; James A. Ward, J. Edgar Thomson: Master of the Pennsylvania (Westport, Conn.: Greenwood Press, 1980), 60-63.

³⁴Report of the Engineer in Chief of the Georgia Rail Road and Banking Co. to the Convention of Stockholders. May 9, 1842. Together with the Cashier's Statement of the Condition of Finances, on 9th May 1842; and Statement of Dividends. Athens, Geo. Printed at the Office of the 'Southern Banner.' June, 1842; Chandler, The Visible Hand, 105-107.

mechanical and civil engineering, from both the North and South, quickly grasped that railroad technology required new methods of management to control its speed, machinery, and manpower. Through much trial and error, southern railroad managers struggled to put new management principles into place. L. O. Reynolds, a northern transplant and superintendent of the Central Railroad of Georgia, for example, divided the administration of his line into a departmental structure in 1842, the same year Thomson had instituted his reforms.³⁵ The Central of Georgia's 1846 salary scale reflected an emerging managerial hierarchy. The Superintendent of Transportation received \$2,000, the Chief Engineer \$2,000, and the Superintendent of Machinery \$1,200. Also in the upper echelon of management, the ticket manager, the assistant engineer, and the forwarding agents at Savannah and Macon all made \$1,000. On the lower level of the organization, receiving clerks earned \$700, book keepers \$600, cotton clerks \$600, passenger train conductors \$600, and the porter \$500. In addition, there were maintenance crews, usually made up of slave labor. Other southern railroads followed a similar structure and divided their lines into separate traffic departments.³⁶

³⁵Eighth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1842), 75-78.

³⁶Twelfth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1846), 151, 156; Black, Railroads of the Confederacy, 28.

By the 1850s, rudimentary bureaucratic structures had developed on most large southern railroads. The Charlotte and South Carolina Railroad's 1854 annual report, for example, complained of a "want of system and economy." In response, the line moved to create a more systematic operation. It developed an organizational chart that listed the officers, sub-officers, and employees to "classify the services" on the road. In this way, the railroad's management hoped to improve the poor "authority and control" that would "not [be] tolerated or permitted on well-managed Northern Roads."³⁷ In addition to drawing up an organizational chart, the Charlotte and South Carolina adopted a bureaucratic structure that included four functional departments--transportation, cars, motive power and machinery, and way. General Superintendent Nims told stockholders this departmental system compared favorably with those "adopted by well-organized Companies" and improved the railroad's "regularity," with trains "seldom failing to arrive and depart in their schedule time."³⁸

By the Civil War, large southern railroads had made considerable strides toward implementing modern bureaucratic structures. F. C. Arms, the chief engineer and superintendent of the Memphis and Charleston,

³⁷Proceedings of the Stockholders of the Charlotte and South Carolina Rail Road Company, at their Sixth Annual Meeting (Columbia, S. C., 1854), 6-8, 44-48.

³⁸Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company, at their Eighth Annual Meeting (Columbia, S. C., 1856), 37.

outlined that railroad's newly installed system of management and control. A large railroad by southern standards, it had 445 cars of different types and functions for 287 miles of track. Its organizational structure consisted of two separate divisions, each with its own superintendent of transportation, master of engines, and track master. Arms explained why a large railroad required a bureaucratic structure. "In the working organization of your Road," he wrote, "two Divisions continue to be operated, to a great extent, independently of each other." This structure differed significantly from a small railroad because on a short road, "the Superintendent may have a personal, and, in some cases, a daily communication with all the officers and employes [sic] of his Road. All irregularities and derelictions of duty come promptly to his knowledge for correction &c." But, he observed "upon a long line, compensation for these advantages, can only be obtained, by the adoption of a system which will involve a proper division of responsibilities" that allowed "great promptness in the report of irregularities; and great care, in the correction of errors, not to embarrass principle officers in their control and influence over subordinates." Sam Tate, the president of the Memphis and Charleston, shared Arms' views. "It takes time and a vast amount of labor to procure a thorough and systematic organization of any large and heavy business," he wrote, "but more especially in this a difficult task on a long Railroad, where there are necessarily so many departments to organize under separate and individual heads, the whole to be looked after by one general head, conferring . . . [with]

absolute power on each head of department." Such an organization proved necessary, he concluded, to enable the railroad to operate with "simplicity, efficiency and economy."³⁹

Besides these organizational changes, southern railroad managers recognized the need for control mechanisms. In response, they classified jobs and implemented new regulations. When a watchman died accidentally while coupling a train, the superintendent of the South-Western Railroad of Georgia blamed the incident on the fact that the watchman attempted to do a job that was "no part of his business." In a similar case, when the South-Western of Georgia had a series of accidents, its superintendent wrote that he had "prescribed such rules and regulations as will prevent . . . future accidents of like character." Railroads enacted strict rules for employees. The East Tennessee and Georgia Railroad made the use of "intoxicating liquors" grounds for dismissal. The preservation of life and property and the complicated requirements of railroad work demanded regulations, noted L. J. Fleming, the general superintendent of the Mobile and Ohio. He argued that rules had to be enforced strictly and any worker breaking them fired immediately. "All experience in railroad management," he wrote in 1857, "has shown that strict discipline and personal responsibility are essential to safety and security of person and

³⁹Seventh Annual Report of the Directors to the Stockholders in the Memphis and Charleston Railroad Company (Memphis, Tenn., 1857), 41, 25-26.

property, and the organization should be formed on these fundamental principles." With this idea in mind, Fleming prepared "rules and regulations accurately defining the duty of each person," which he printed and distributed to all workers. He stated that "strict adherence to all their requirements will be considered the only condition of remaining in the Company's services."⁴⁰

Fleming required daily reports from both agents and conductors. These reports contained the arrival and departure of all trains. Further, he wanted a list of all "discrepancies or failure in the delivery of freight, the amount on hand and the cars required for its transportation." Fleming demanded vouchers that showed "in detail" the movement of all freight and passengers. These vouchers had to be signed by the head of the appropriate department and had to be approved by the superintendent. He hoped this system of control would "contain the . . . detentions and irregularities of trains, in the delivery of freight," and noted that "additional precautions may be adopted if necessary to prevent a recurrence. A few years later, in his report on a collision between a passenger train and a freight train, he concluded that it was caused by "running out of time [not on schedule], and positively contrary to the printed regulations for the

⁴⁰Ninth Annual Report. South-Western Railroad Co. (Macon, Ga., 1856), 246-247; Report of the President and Directors of the East Tennessee and Georgia Railroad Company (Athens, Tenn., 1857), 18-19; Seventh Annual Report. South-Western Railroad Co. (Macon, Ga., 1854), 197-198; Ninth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Co. (Mobile, Ala., 1857), 51.

government of the employees of the Company." Clearly, southern railroad managers had come to understand that workers needed to follow rules and to stay within their job classifications.⁴¹

In addition to rules and regulations, southern railroads implemented detailed accounting procedures. Annual reports to stockholders and state authorities included tables that specified the condition of locomotives, number of miles run, wood burned, oil used, and cost of repairs. When he set up the accounting procedures for the Memphis and Charleston Railroad, Chief Engineer Charles F. M. Garnett emulated northern railroads. "All the railroad companies in the Union," he observed, "are in the habit of keeping an accurate account of annual expenses, from the salaries of their officers down to the oil used to grease a locomotive." The Charlotte and South Carolina Railroad also developed ledgers that helped control cost. The line reported monthly earnings, monthly expenditures, and a cost breakdown of transportation, maintenance, machine shop, loss and damages, construction, and freight and passenger traffic. Moreover, it listed the amount paid to each employee from the president down to the train boys.⁴²

⁴¹Proceedings of the Ninth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Company (Mobile, Ala., 1857), 51; Twelfth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Co. (Mobile, Ala., 1860), 14.

⁴²The First Annual Report of Charles F. M. Garnett, Chief Engineer of the Memphis & Charleston Rail Road (Huntsville, Ala., 1851), 6; Proceedings of the Stockholders of the Charlotte and South Carolina Rail Road Company, at their Sixth Annual Meeting (Columbia, S. C., 1854), 33-42.

Southern railroad managers also tried to establish systematic maintenance programs. Heavy rains and floods frequently caused mud slides that damaged track and bridges. Further, railroad ties rotted and needed replacement on a regular schedule. As early as 1842, L. O. Reynolds urged stockholders of the Central of Georgia not to cut expenditures after the completion of the road. "The subject of 'maintenance of the way,'" he explained, "is one of the most important of all matters connected with the management of the railway." He warned investors that it would be "a great error to suppose it is the best policy, to cut down the expenses of repairs of [the] Road to the lowest possible sum that will keep the Road in operation." Such a policy, he argued, would cause an "over-strained economy" that would "result in constant derangement of machinery, in the mechanical department, more than equivalent to the apparent savings." If maintenance investment went unmet, Reynolds predicted, the railroad would experience an abundance of accidents. William Johnson, the president of the Charlotte and South Carolina, agreed. "Experience has proved," he told stockholders, "that it is cheaper to keep the bed and track of a railroad in a safe and sound condition, than otherwise." He observed that maintenance improved the condition of machinery as well as safety. Moreover, it contributed to the public's confidence in the railroad which he argued was an "essential"

element "in the success of all corporations, and especially so, in regard to railroad companies."⁴³

Large southern railroads established regular schedules for track repair. The Central of Georgia, for example, used 400 slaves for both construction and maintenance in 1849. W. M. Wadley, its superintendent, informed stockholders that the company had invested in tools, shanties, and tents to enable the maintenance crews to live on the track. Similarly, the South-Western Railroad of Georgia built tent-cars that slept fifty. These tent-cars allowed constant work on foundations, ditches, culverts, and slopes. Beyond this, every large southern railroad built maintenance shops to repair locomotives and cars. Some even constructed their own freight and passenger cars. The South-Western, for example, built its own freight cars, box cars, platform cars, wheel cars, and second-class passenger cars. The Southern Railroad had a workshop in Vicksburg, Mississippi, that employed over 100 mechanics, many of them slaves. The Memphis and Charleston constructed shops to build freight cars in Huntsville, Alabama. R. R. Cuyler told Central of Georgia stockholders in 1860 that the line constructed its own

⁴³Eight Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1842), 77-79; Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at their Ninth Annual Meeting (Columbia, S. C., 1857), 13-14.

motive power and wanted "to avoid all purchases of these articles in the future."⁴⁴

Besides implementing regularly scheduled track repairs, southern railroad managers also embraced the new technology in development. Most of the major southern railroads adopted the improved T rail over the flat bar by the 1850s. The Charlotte and South Carolina Railroad, which adopted the T rail in 1856, reported that it "will be the best economy in the end . . . as well as security of the Road against accident and contingent loss." The entire line of the Memphis and Charleston, completed in 1857, consisted of English T rail.⁴⁵ Moreover, southern railroads encouraged the development of telegraph lines, the spread of which allowed for improved communication and control. The Central of Georgia began using the telegraph in 1847, only three years after Morse demonstrated its practicability. The general

⁴⁴Fifteenth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1849), 200, 208; Seventh Annual Report. South-Western Railroad Co. (Macon, Ga., 1854), 199; Eleventh Annual Report. South-Western Railroad Co. (Macon, Ga., 1858), 306; Annual Report of the President and Directors of the East Tennessee & Georgia Railroad Company (Athens, Tenn., 1851), 8; John Hebron Moore, The Emergence of the Cotton Kingdom in the Old Southwest: Mississippi, 1770-1860 (Baton Rouge: Louisiana State University Press, 1988), 194; Black, Railroads of the Confederacy, 23-24.

⁴⁵Fifth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1840), 53; Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company at their Eighth Annual Meeting (Columbia, S. C., 1856), 7; Seventh Annual Report of the Directors to the Stockholders in the Memphis and Charleston Railroad Company (Memphis, Tenn., 1857), 16; The Reports of the Committees of the House of Representatives made during the Second Session Thirty-Ninth Congress, 1866-'67. 4 vols. (Washington: Government Printing Office, 1867), 692-703.

superintendent of the South Carolina Railroad told investors in 1856 that its new telegraph line would not only improve "convenience of . . . travel" but also would create "the means of preserving greater regularity in the through connections." In 1861, the Richmond & Danville created a telegraph department with a superintendent, six operators, and three messengers.⁴⁶

None of this is to say, however, that southern railroads were perfectly organized. Despite their bureaucratic structures and control mechanisms, coordination problems plagued them. Different lines often did not connect even when they served the same city, and in some cases they used different gauged track, which made the transport of through freight a logistical nightmare. It was not uncommon for a train to be unloaded, its contents carried by teamsters across town, and then reloaded on another company's

⁴⁶Thirteenth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1847), 167; Annual Reports of the President and Directors and the General Superintendent of the South Carolina Railroad Company (Charleston, 1856), 9; The telegraph expanded rapidly in the South after 1847. The two largest corporations in the South were the American Telegraph Company and the Southwestern Telegraph Company. The major lines included the Washington and New Orleans Company (the second oldest in the country), that covered 1,700 miles and connected Richmond, Charleston, Savannah, Montgomery, and Mobile. The Washington and Memphis Telegraph Company connected Lynchburg, Virginia, and Washington. The Abingdon Telegraph Company tied Richmond and Bristol, Tennessee, together. The East Tennessee Telegraph Company connected Bristol to Chattanooga. There were some 283 telegraph offices in the South by 1860. J. Cutler Andrews, "The Southern Telegraph Company, 1861-1865: A Chapter in the History of Wartime Communication," Journal of Southern History 30 (August 1964): 319-320; Robert Luther Thompson, Wiring a Continent: The History of the Telegraph Industry in the United States, 1832-1866 (Princeton: Princeton University Press, 1947), 141-143; Black, Railroads of the Confederacy, 35.

train. T. J. Turner, a superintendent of the Charlotte and South Carolina, acknowledged in 1859 that connections between different railroads made "freight service . . . more varied and difficult." F. C. Arms complained that passengers at several of their stations suffered delays of up to 14 hours due to "the failure of connecting Roads to make closer connections." When railroad companies did tie their services together, other logistical problems developed. The Central of Georgia's W. M. Wadley noted he often had difficulty locating his railroad cars once they had been connected to another company's train. In fact, he told stockholders in 1855 that he feared "we have lost quite a number." The Memphis and Charleston did not want to connect with the Nashville and Chattanooga Railroad because the managers thought the different time schedules and tariff rates, as well as the inconvenience to travelers and damage to packages, would make operations too difficult. In like manner, the East Tennessee and Georgia railroad reported that the "interchanging [of] cars with other roads has been the source . . . of nearly if not quite all our damages and difficulties in forwarding freight."⁴⁷

⁴⁷Taylor and Neu, American Railroad Network, 41-48; Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company (Columbia, S. C., 1859), 25-26; Seventh Annual Report of the Directors to the Stockholders in the Memphis and Charleston Railroad Company (Memphis, Tenn., 1857), 40-41; Twenty-First Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1855), 39; Third Annual Meeting of the Stockholders of the Memphis and Charleston Railroad Co. (Huntsville, Ala., 1853), 30; Report of the President and Directors of the East Tennessee and Georgia Rail Road Company (Athens, Tenn., 1857), 13; Seventh Annual Report. South-Western Railroad Co. (Macon, Ga., 1854), 197-198.

The lack of a systematic freight or tariff policy compounded these difficulties. Due to inherent weaknesses in a fragmented and uncoordinated railroad system, through rates varied considerably from those posted. Beyond logistics, competition for business between different lines caused significant problems in setting through rates.⁴⁸ Southern railroad managers admitted as much. "It is contended," L. O. Reynolds' wrote as early as 1841, "that we have yet arrived at the precise point in the arrangement of our tariff of freights." Tariff problems grew as railroad mileage spread and coordination problems increased. To complicate matters, planters and farmers complained that through rates were cheaper for those hauling cotton longer distances. For their part, southern railroad managers argued that through rates increased efficiency. "The idea that injustice is done to the traders and planters when we reduce through rates without corresponding reduction of way rates," R. R. Cuyler of the Central of Georgia argued in 1844, "is fallacious." In other words, southern railroad managers grappled with the idea of economies of scale within a fragmented railroad system. "The necessity [of lower through rates]," Cuyler maintained, was "imposed on us by nature. . . . [T]here should be a corresponding fall in rates through the whole line." This principle, he argued, had been "learned by . . . observation and thorough experience." John Childe, the Superintendent of

⁴⁸Black, Railroads of the Confederacy, 38; Klein, Great Richmond Terminal, 16-29.

the Mobile and Ohio Railroad, agreed. It must be understood, he explained, "that the expenses of a full train are but a trifle more than those of one a quarter or half loaded." Despite this understanding, the system of railroad rates remained unsophisticated in the pre-war South.⁴⁹

In addition to problems with freights rates and service, the lack of coordination also impaired safe operations. In 1854, the South-Western of Georgia reported several "serious accidents" due to increased traffic. Railroad work remained extremely dangerous. For example, in December 1860, a Central Railroad of Georgia freight train and a passenger train collided, killing a train hand and several passengers. The South-Western Railroad reported that a slave employed on a "gravel train fell between the cars" and was crushed under the wheels. A Memphis and Charleston train ran over a young slave employee when he tried to jump between two cars. The Mobile and Ohio Railroad reported that a conductor and another railroad employee died when their train struck a cow on the tracks and derailed.⁵⁰

⁴⁹Ninth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1844), 85; Proceedings of the Eighth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Company (Mobile, 1856), 32; Black, Railroads of the Confederacy, 38-39.

⁵⁰Seventh Annual Report. South-Western Railroad Co. (Macon, Ga., 1854), 197-198; Twenty-Sixth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1860), 175; South-Western Railroad Co. (Macon, Ga., 1857), 272; Fifth Annual Report of The Board of Directors to the Stockholders in the Memphis and Charleston Railroad Company (Memphis, Tenn., 1855), 44; Proceedings of the Ninth Annual Meeting of the

As these accidents and coordination problems suggest, the operations of southern railroads still had considerable problems in the antebellum period. Nevertheless, southern railroads had grown rapidly in the 1850s and had implemented many of the organizational ideas identified with northern railroad management. The South, in terms of railroads, took the same path to modernization as the North, except for one critical difference--slave labor. Bureaucratic organization and railroad modernization in the South incorporated within its framework the "peculiar institution."

Southern railroad managers had no problem with using slave labor. Progress and slavery went hand in hand in their minds. Few would have disagreed with B. Ayers, superintendent of the Memphis and Charleston, when he wrote in 1855, "The economy of slave labor upon Southern roads has been frequently demonstrated" and "it will no doubt be greatly to their advantage to own the labor required in working the road."⁵¹

As slave prices increased with cotton prices in the late 1840s and 1850s, railroad managers debated whether to rent or buy slaves. Several lines opted to continue contracting for slave labor. The Charlotte & South Carolina even allowed stockholders to pay for their stock with slaves. Edward G. Palmer, the road's president, observed that "allowing

Stockholders of the Mobile & Ohio Rail Road Company (Mobile, Ala., 1859), 18.

⁵¹Fifth Annual Report of the Board of Directors to the Stockholders in the Memphis & Charleston Railroad Co. (Memphis, Tenn., 1855), 44.

Stockholders to pay up their subscriptions in labour . . . is admirably calculated to increase the amount of stock subscribed . . . and give slave States great advantages over the free in the construction of Rail Roads." The Central of Georgia, however, decided to end the contract system that year in favor of direct ownership of slaves. President Cuyler thought that slaves purchased by the railroad worked more efficiently, created a safer working environment, and received better medical care. Other railroads followed suit. The Nashville & Chattanooga invested more than \$128,000 in slaves, the Raleigh & Gaston purchased \$125,000 worth of slaves, and the South Carolina bought 90 slaves valued at more than \$80,000.⁵²

The decision to purchase slaves centered primarily on tight market conditions. The chief engineer of the Richmond & York Railroad, reported in 1856 that the supply of labor appeared so scarce that rented slaves were almost "impossible" to obtain. In response, he argued, the railroad should consider buying slaves. In addition, railroad contracts with slave owners required negotiations and strict guidelines, with the railroad usually providing the rented slaves with shelter, food, clothing, and medical care. Beyond these costs, the railroad had to pay rent to the slaveholder. Furthermore, if a slave suffered injuries or death, the railroad had to reimburse the owner for the value of the slave. The Richmond & Danville,

⁵²Proceedings of the Charlotte & South Carolina Railroad at their Second Annual Meeting at Winnsboro (Columbia, S. C., 1849), 4; Fifteenth Report. Central Railroad and Banking Co. of Georgia (Savannah, Ga., 1849); 200; Black Railroads of the Confederacy, 29-30.

for instance, paid \$1,379.44 for a slave laborer killed in an accident. To avoid such payments, some railroads stipulated contractually that the company bore no responsibility "for accidents from any cause whatever." Tension between the slave owner and the railroad company over proper treatment as well as punishment of slaves proved inevitable. Some railroad managers soon decided they needed greater control over slave labor than the contract system allowed.⁵³

Despite some tension between railroad companies and slave holders, slave labor played an important role in southern railroad operations. Slaves constructed and maintained most of the tracks in the South, but they also served as brakemen, firemen, station helpers, and in some cases, enginemen.⁵⁴ The annual reports of the Charlotte and South Carolina Railroad provide a look at the varied use of slaves. Blacks, mostly slaves, performed a variety of tasks on the line. They worked as blacksmiths, firemen, strikers, depot hands, and pump tenders. A large number of slaves worked at laying and repairing track. Although slaves performed many of the same jobs as white wage earners, the railroad reported that slaves cost less. For example, a black carpenter cost the Charlotte line \$20 per month

⁵³Second Annual Meeting of the Stockholders of the Richmond and York R. R. Co. (Richmond, Va., 1856), 19; Walter Licht, Working for the Railroad: The Organization of Work in the Nineteenth Century (Princeton: Princeton University Press, 1983), 68-69, 88-89.

⁵⁴Walter Licht, Working for the Railroad: The Organization of Work in the Nineteenth Century (Princeton: Princeton University Press, 1983), 67.

(apparently in rental fees) and board, while a white carpenter received \$1.50 per day in wages, or about \$40 a month on a six-day workweek. A black foreman cost the company \$15 per month compared to \$35 per month for a white foreman. Clearly, the managers of the Charlotte and South Carolina Railroad along with other southern roads had no qualms incorporating slave labor within their bureaucratic system.⁵⁵

Because of their dependence on slave laborers, railroad rulebooks carefully defined the proper treatment of slaves within a bureaucratic organization. The Memphis and Ohio Railroad allowed its slaves to be whipped, but it also enforced a rule stating that punishment "must be administered in moderation, and within the bounds of the law, which is not to exceed thirty-nine lashes." The M&O rulebook also forbade hitting a slave with a club, stick, fist, or other heavy object. With such rules and regulations guiding discipline on southern railroads, it could be argued that slaves who worked for railroads suffered less gratuitous violence and labored in a more rational working environment. However, the proposition that an impersonal and bureaucratic railroad organization

⁵⁵Proceedings of the Stockholders of the Charlotte and South Carolina Rail Road Company at their Sixth Annual Meeting (Columbia, S. C., 1854), 39-40; Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at the Seventh Annual Meeting (Columbia, S. C., 1855), 43-45; Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at their Eighth Annual Meeting (Columbia, S. C., 1856), 35-36; Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at their Ninth Annual Meeting (Columbia, S. C., 1857), 28-29.

treated slaves better than plantation owners is debatable. A veteran slave trader wrote tellingly to a colleague in Richmond, Virginia, that "if I dont [sic] come home I shall not let my negroes work on the Rail Road any longer than this week for they dont take care of them and it is better to feed them and let them do nothing than to have them crippled up and no care taken of them."⁵⁶

The work done by slave labor was very dangerous. Most toiled at grading, ditching, track laying, and track repair. Injury and disease claimed many casualties. Most railroads reported the loss of workers to epidemics and cholera. The superintendent of the Memphis and Charleston observed that contractors and their slaves have "several times dispersed by the appearance of cholera and other malignant diseases." The East Tennessee and Georgia noted the "prevalence of epidemic disease." In 1841, the Central of Georgia told "of much sickness on some parts of the line among the laborers." The next year it reported "almost universal prevalence of fever among our operatives."⁵⁷ These complaints were a common theme in annual reports.

⁵⁶Licht, Working for the Railroad, 68-69, 88-89; A. Rux to E. H. Stokes, December 18, 1861, Cornelius Chase Papers, Library of Congress, Manuscripts Division, Washington D. C.; See also Eugene D. Genovese, Roll, Jordan, Roll: The World the Slaves Made (New York: Random House, 1976), 3-112; and Joseph P. Reidy, From Slavery to Agrarian Capitalism in the Cotton Plantation South: Central Georgia, 1800-1880 (Chapel Hill: The University of North Carolina Press, 1992), 31-81.

⁵⁷Third Annual Meeting of the Stockholders of the Memphis and Charleston Railroad Co. (Huntsville, Ala., 1853), 15; Annual Report of the

Grading the roadbed also meant working with gunpowder and blasting. The Central of Georgia, which had construction crews numbering over five hundred slaves, determined that the crews needed to “blast the rock in every excavation.” A Greensboro, North Carolina, newspaper reported that two slaves were hurt “when an explosion took place, blowing the drill out of the hole and taking with it the little finger of the boy who held it, the eye of the other was injured by a [sic] gravel, which seems to have sunk into the [eye]ball.” Other jobs also proved hazardous for slaves. Special timber and gravel trains hauling gangs constantly moved up and down the line doing repairs. The Central of Georgia described it as a “gang of hands, with a small engine and train of cars, engaged . . . in clearing out ditches in the deep cuts . . . and filling up trestle bridges.” The Mobile and Ohio’s accident reports show a large number of slave laborers hurt during construction and operation of the line. For example, the line reported that a black worker “employed on Gravel Train, was run over and killed by [a] regular Train.” When a train derailed, two brakeman died instantly and the fireman was “so scalded that he died the next day.” A brakeman standing on top of the cars died when he hit the top of the Quitman Bridge. A switchman attempting to get on the engine slipped and had his leg cut off

President and Directors of the East Tenn. and Ga. Railroad Co. (Athens, Tenn., 1855), 8; Seventh Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1841), 63; Eighth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1842), 73.

when run over by a train. Obviously, slaves as well as white workers faced a significant chance of injury or even death.⁵⁸

Not surprisingly, slaves tried to escape from railroad work. White workers could simply quit a job they did not like; slaves remained in bondage. In January and February 1858, the Charlotte and South Carolina purchased seven slaves for the amount of \$6,250. Titus, the most expensive, cost \$1,000. Three of the slaves worked in the shops and the others as train hands. The next year the company sold Titus because of "his habit of running away from service rendered this expedient." They sold him at cost for \$1,000. In his place they purchased "Sam, his wife and three children" for \$2,550.⁵⁹

In jobs where whites and blacks were both employed, especially in construction, the groups were typically segregated and placed on different sections of the line.⁶⁰ Conflicts over slavery nevertheless occurred. In 1839,

⁵⁸Second Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1838), 30; Greensboro newspaper quoted in Nelson, Iron Confederacies, 19; Seventeenth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1851), 243; Proceedings of the Ninth Annual Meeting of the Stockholders of the Mobile and Ohio Rail Road Company (Mobile, Ala., 1857), Table 10.

⁵⁹Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at their Tenth Annual Meeting (Columbia, S. C., 1858), 11; Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at their Eleventh Annual Meeting (Columbia, S. C., 1859), 10.

⁶⁰Proceedings of the Stockholders of the Charlotte and South Carolina Railroad Company at their Eighth Annual Meeting (Columbia, S. C., 1856),

the Central of Georgia confronted fighting and bitterness over this issue.

"Some disturbances originating from sectional differences among the laborers," Superintendent Reynolds reported, "interrupted for a short time the harmony which had previously prevailed throughout the line." In response, the contractors resorted "to the employment of blacks altogether." In his next report, Reynolds argued that his views "on the subject of the employment of slave labor have been much strengthened by the experience of the last Summer."⁶¹ When conflict arose with white laborers, management could simply dismiss them.

Despite difficulties with slaves and slave owners, southern railroad managers praised the use of slave labor. Unlike northern free labor, slaves could not strike, and many southern railroad managers argued that they cost less than free labor. Reynolds told stockholders that slaves proved "perfectly adapted to the construction of internal improvement" and guarded against the "fluctuations and vicissitudes" of northern free labor. Edward Palmer, president of the Charlotte and South Carolina, declared slave labor more "economical" and "efficient" than free labor. John Childe, chief engineer of the Mobile and Ohio, agreed. He proffered that "owning and controlling"

36; Eleventh Annual Meeting of the Stockholders of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1859), Table 12.

⁶¹Third Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1839), 34; Fourth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1839), 44.

slave labor "freed" southern railroads "from the fluctuations incident to the employment of foreigners."⁶²

Thus it was on the issue of slavery, and not on ideas about economic modernization, that the North and South differed. Southerners, like their northern counterparts, believed that railroads would transform their economy. Despite much historiographical debate over modernization in the antebellum South, a study of southern railroads discloses that the South embraced the same bureaucratic ideals that Alfred Chandler discovered at work on northern railroads.⁶³ By developing similar organizational structures, job specialization, rules and regulations, accounting procedures,

⁶²Third Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1839), 32-35; Proceeding of the Charlotte and South Carolina Railroad at their Second Annual Meeting at Winnsboro (Columbia, S. C., 1849), 4; Proceedings of the Fifth Annual Meeting of the Stockholders of the Mobile & Ohio Rail Road Company (Mobile, 1853), 16.

⁶³On the modernization debate, see Eugene D. Genovese, The Slaveholders' Dilemma: Freedom and Progress in Southern Conservative Thought, 1820-1860 (Columbia: University of South Carolina Press, 1992); J. Mills Thornton III, Politics and Power in a Slave Society: Alabama, 1800-1860 (Baton Rouge: Louisiana State University Press, 1978); Lacy K. Ford, Jr., Origins of Southern Radicalism: The South Carolina Upcountry, 1800-1860 (Oxford: Oxford University Press, 1988); James Oakes, Slavery and Freedom: An Interpretation of the Old South (New York: Vintage Books, 1990); Laurence Shore, Southern Capitalists: The Ideological Leadership of an Elite, 1832-1885 (Chapel Hill: The University of North Carolina Press, 1986); John Ashworth, Slavery, Capitalism, and Politics in the Antebellum Republic. Vol. 1: Commerce and Compromise, 1820-1850 (Cambridge: Cambridge University Press, 1995); Gavin Wright, The Political Economy of the Cotton South: Households, Markets, and Wealth in the Nineteenth Century (New York, 1986); Fred Bateman and Thomas Weiss, A Deplorable Scarcity: The Failure of Industrialization in the Slave Economy (Chapel

and technology, the South mirrored the North in many respects. What did distinguish the two systems was that white southerners firmly believed that economic progress included the “peculiar institution.”

Railroad modernization also influenced southern thought. Sam Tate, the president of the Memphis and Charleston, saw a South transformed by the railroad. Along the line he saw a “division” of “labor and capital” associated with the beginning of manufacturing. He admired new mills, grist mills, flouring mills, foundries, railroad car factories, wagon shops, and cotton factories. He believed railroads would allow the South to rival New England for economic growth.⁶⁴ Others agreed. Some believed they saw a new South emerging in the 1850s. New ideas affected how southerners viewed railroads, factories, and farms. Indeed, southern farmers and planters, such as Isham Howze, discussed and implemented new bureaucratic ideas of system, uniformity, and control.

Hill: The University of North Carolina Press, 1981); Smith, Mastered by the Clock, 70-92.

⁶⁴Seventh Annual Report of the Directors of the Stockholders in the Memphis Charleston Railroad Company (Memphis, Tenn., 1857), 28; Ninth Annual Report of the Directors to the Stockholders in the Memphis and Charleston Railroad Company (Memphis, Tenn., 1859), 18.

CHAPTER 2

SYSTEM AND ORGANIZATION IN THE ANTEBELLUM SOUTH

The rapid growth of railroads played an important role in the diffusion of bureaucratic and systematic ideas during the 1840s and 1850s. Southern railroad managers, like their northern counterparts, began to list officers and workers in rough organizational charts and govern their activities according to rules and regulations. In addition, southern railroads adopted complex accounting methods to control goods and services. In many ways, these organizational ideas aligned with progressive southerners' conceptions of efficient management of plantations and of society. Like the railroads, the northern factory system influenced southern attitudes toward labor efficiency and discipline.¹

¹See especially, Alfred D. Chandler, The Visible Hand: The Managerial Revolution in American Business (Cambridge: Harvard University Press, 1977); James R. Beniger, The Control Revolution: Technological and Economic Origins of the Information Society (Cambridge: Harvard University Press, 1986); David A. Hounshell, From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States (Baltimore: The Johns Hopkins University Press, 1984); Merritt Roe Smith, Harpers Ferry Armory and the New Technology: The Challenge of Change (Ithaca: Cornell University Press, 1977); Herbert G. Gutman, "Work, Culture, and Society in Industrializing America, 1815-1919," The American Historical Review 78 (June 1973): 531-588; Louis Galambos, "Technology, Political Economy and

Contrary to conventional historical wisdom, reform minded southerners admired much of what they saw in the North. Only in the late 1850s, as sectional hostility peaked, did Southerners condemn northern society and its factory system. In fact, southern reformers saw this system in the North not as evil but as beneficial to the South's prosperity. Some Southerners examined northern business practices and reforms and emulated them. One reformer, for instance, compared the "system" he found in New England's textile mills with that on southern plantations. Each had "particular departments" that arranged the production process systematically. Another writer for a southern agricultural journal admired the technology in northern factories and expressed his belief that the South, like the North, needed to combine "the plow, the loom, and the anvil."

Professionalization: Central Themes of the Organizational Synthesis," Business History Review 57 (4): 471-493; Joyce Chaplin, An Anxious Pursuit: Agricultural Innovation and Modernity in the Lower South, 1730-1815 (Chapel Hill: University of North Carolina Press, 1993); James Oakes, Slavery and Freedom: An Interpretation of the Old South (New York: Vintage Books, 1990) and "From Republicanism to Liberalism: Ideological Change and the Crisis of the Old South," American Quarterly 47 (Autumn 1985): 551-571; Mark M. Smith, Mastered by the Clock: Time, Slavery, and Freedom in the American South (Chapel Hill: University of North Carolina Press, 1997); Laurence Shore, Southern Capitalists: The Ideological Leadership of an Elite, 1832-1885 (Chapel Hill: University of North Carolina Press, 1986); Vicki Vaughn Johnson, The Men and the Vision of the Southern Commercial Conventions, 1845-1871 (Columbia: University of Missouri Press, 1992); Paul F. Paskoff, "Invention and Culture in the Old South, 1790-1860," Unpublished Paper delivered at Works-in-Progress Seminar, Louisiana State University, November 1991.

Henry Clay, the father of the American System, asked rhetorically after viewing northern textile mills, "Who has not been delighted with the clock-work movements of a large cotton factory?"²

Such commentators demonstrate that progressive southerners did not fear economic modernization brought on by the railroads or industry. This is not to say, however, that reformers did not face resistance from upcountry farmers and those who feared the effects of modernization.³ Nevertheless, southern reformers transformed new industrial ideas of system, technology, organization, and control into a unique vision of modernization based on agriculture and slave labor. They applied organizational structures, usually associated with the northern states, to several aspects of southern society. Agricultural and educational reform, as well as agricultural and commercial organizations, were the clearest expressions of these new organizational innovations.

²"Domestic Industry--Manufactures at the South," De Bow's Review 8 (February 1850): 142; "The Seven Wonders of New England," Southern Cultivator 6 (December 1848): 186; Clay quoted in Gutman, "Work, Culture, and Society," 551.

³On southern resistance, see especially Eugene D. Genovese, The Political Economy of Slavery: Studies in the Economy and Society of the Slave South (New York: Pantheon Books, 1965); Thornton, Politics and Power in a Slave Society, 267-342; Ford, Jr. Origins of Southern Radicalism, 308-337; Gavin Wright, The Political Economy of the Cotton South: Households, Markets, and Wealth in the Nineteenth Century (New York: W. W. Norton & Company, 1978), 89-127.

Both the North and the South embraced economic modernization and the new organizational structures associated with it. For example, southern agricultural reformers espoused making "factories in the fields."⁴ Southern agricultural journals trumpeted the virtue of system and uniformity and proposed a more efficient organization of plantation labor, the adoption of new agricultural implements, and better accounting methods. Similarly, educational reformers encouraged order, efficiency, and bureaucratic control for southern schools. They averred that technical schools and agricultural colleges would allow the South to reap the benefits

⁴James Oakes, The Ruling Race: A History of American Slaveholders (New York: Alfred A. Knopf, 1982), 153-191; Kenneth M. Stampp, The Peculiar Institution: Slavery in the Ante-Bellum South (New York: Vintage Books, 1956), 34-85; Robert William Fogel and Stanley L. Engerman, Time on the Cross: The Economics of American Negro Slavery (Boston: Little, Brown and Company, 1974), 191-209; John Hebron Moore, The Emergence of the Cotton Kingdom in the Old Southwest: Mississippi, 1770-1860 (Baton Rouge: Louisiana State University Press, 1988), 77-115; Jacob Metzger, "Rational Management, Modern Business Practices, and Economies of Scale in the Ante-Bellum Southern Plantations," Explorations in Economic History 12 (1975): 123-150; R. Keith Aufhauser, "Slavery and Scientific Management," Journal of Economic History 33 (December 1973): 811-824; Giorgio Canarella and John A. Tomaske, "The Optimal Utilization of Slaves," Journal of Economic History 35 (September 1975): 621-629; Chester McArthur Destler, "David Dickson's 'System of Farming' and the Agricultural Revolution in the Deep South, 1850-1885," Agricultural History 31 (3) (1957): 30-39; G. Melvin Herndon, "Agricultural Reform in Antebellum Virginia: William Galt, Jr., A Case Study," Agricultural History 52 (3) (1978): 394-406; Weymouth T. Jordan, "Noah B. Cloud and the 'American Cotton Planter,'" Agricultural History 31 (3) (1957): 44-49; Robert W. Williams, "Thomas Affleck: Missionary to the Planter, the Farmer, and the Gardener," Agricultural History 31 (3) (1957): 40-48.

of technological progress without disturbing the social order based on slavery.

In addition, the introduction of the railroad and the expansion of the market spurred the growth of agricultural and commercial organizations. Southern farmers and plantation owners formed agricultural societies for a variety of purposes. Primarily, they organized themselves to take advantage of the market expansion that resulted from the railroad. These organizations encouraged better farming techniques, efficient plantation management, crop diversification, and technological progress. Correspondingly, southern commercial conventions, formed by the elite in southern society, promoted railroad expansion, river maintenance, agricultural improvement, and industrial development.⁵

The antebellum South, like the North, struggled with modernization and reform. Southerners did not live in an economic or social vacuum. They perceived the changes created by industry and the railroad. By the 1840s and 1850s, southern reformers accepted the ideas associated with a modern economy: system, uniformity, technology, organization, and bureaucratic control. In defense of their agrarian culture they applied them to the plantation, to education, and to the market. Progressive southerners perceived themselves as rational men adapting to a changing economy and

⁵Johnson, Southern Commercial Conventions, 1-12.

society. They envisioned a society that united technology, organization, and education. They embraced both modernization and the "peculiar institution."⁶

The introduction of the railroad, the expansion of the market, and the emergence of the American system of manufacturing created a new organizational mentality in the antebellum North and South. Southern reformers saw themselves as part of, not separate from, industrial changes and the expanding market structure. Modern technology and organizational ideas captured their imagination. In the 1840s and 1850s, southerners commented frequently on the influence of machinery and steam power. Progressive southerners employed machines and steam power as metaphors for social progress. Editorialists wrote of the transforming power of steam and the railroad in the South. De Bow's Review, the South's leading industrial journal, compared "civil society" to a "machine" where "labor, capital, and intelligence" formed essential parts of social progress. "It cannot be denied," marveled an editorial writer from Alabama, "that the Steam engine has the social, moral, and political, as well as a potent physical energy" to create a "modern civilization" by converting "the wilderness into

⁶On the modernization debate see, Eugene D. Genovese, The Slaveholders' Dilemma: Freedom and Progress in Southern Conservative Thought, 1820-1860 (Columbia: University of South Carolina Press, 1992); Smith, Mastered by the Clock, 70-92; Drew Gilpin Faust, "The Rhetoric and Ritual of Agriculture in Antebellum South Carolina," Journal of Southern History 45 (November, 1979): 541-568.

a garden." Steam power, a symbol of the age, brought effusive praise in southern journals: "The revolution occasioned in the world by the application to purposes of land communication of the wonderful element of steam," one journal crowed, will improve the South "morally, socially, politically . . . for a century of progress." Steam power had "diminished labour, destroyed space, lengthened time, and created a new world."⁷

The new world of the railroad, industry, and the market influenced how Southerners viewed their farms and plantations. Bureaucratic ideas grew more fertile as Southerners tried to fit their slave economy into an increasingly mechanized and organized national economy. Agricultural reformers espoused a system of plantation management that differed little from the bureaucratic structures and business practices of railroads and factories. System, uniformity, and control became their mantra.

Southern agricultural reformers shared railroad and factory managers' respect for rules, regulations, control of time, system, and rudimentary bureaucratic structures. Furthermore, systematic management encouraged accounting practices, proper slave management, and the use of new technology. It also became the subject of many articles in southern journals. For instance, a writer for the Southern Planter urged his fellow

⁷"Commercial Spirit of the South," De Bow's Review 2 (September 1846): 120; "Rail Roads," American Cotton Planter 1 (1853): 25; "Railway Systems and Projects in Europe and America," De Bow's Review 3 (February 1847): 138.

southerners to run their plantations efficiently. "System" he wrote, "is as essential in farming as in any other occupation of life." By system, he meant making strategic plans for planting, keeping a tight inventory, and using an accounting book.⁸ Other southerners echoed the call for system and connected technological progress with plantation management. As one reformer wrote, "a plantation might be considered as a piece of machinery; to operate successfully, all its parts should be uniform and exact, and the impelling force regular and steady; and the master . . . should be their impelling force."⁹ Thus, a plantation should run much like a machine, with system and uniformity of action. Clearly, these agricultural reformers accepted new ideas developed by an industrializing society.

By the 1850s, the virtue of system and uniformity had become such an ingrained idea that a contributor to the Southern Planter signed his editorial "A Lover of System." He applied the ideals of business efficiency to southern agriculture. The first item of importance in running a systematic farm, he asserted, was the use of a "day book." In it all work was to be recorded and arranged in the most efficient manner. Regulations had to be strictly enforced. The farmer needed to "be firm and unflinching in seeing that" his "rules are carried out to the letter by overseer and slaves. Do not

⁸"System," Southern Planter 1 (February 1841): 29.

⁹"Mgmt. of Slaves," Southern Cultivator 4 (March 1846): 44.

let rules be violated." Finally, the farm or plantation should be well ordered and implements placed in assigned locations. "Let system be found on every part of your farm," he wrote, "and in all your management, [and] you will certainly prosper."¹⁰ The practices he prepared for farming followed the bureaucratic methods associated with modern management: rules, regulations, proper accounting, and control of labor.

Careful record keeping became an especially important component in the systematic management of plantations. A Louisiana planter listed proper accounting as the first rule of successful management. All items on a plantation, he maintained, must be accounted for with "a full, perfect, and accurate list, or inventory." To keep a firm grasp of profit and loss, accounts needed to be updated on a quarterly basis. As a consequence of the emphasis upon systematic bookkeeping, advertisements for accounting books flourished in antebellum southern journals and newspapers. By all matter and means, agricultural reformers encouraged the use of these books to control costs, labor, inventory, and planting information.¹¹

These agricultural reformers often noted how railroads, banks, and other businesses used accounting methods to improve system and control. "The merchant, banker, tradesman, and almost every other business man

¹⁰"Necessity of System," Southern Planter 10 (January 1850): 30.

¹¹"Rules in the Management of a Southern Estate" De Bow's Review 21 (December 1856): 617.

keeps an account of his affairs regularly and punctually," one observed. Farms, he explained, must not be run in a "hap-hazard manner," without "system" or "clockwork regularity." Another agreed. As manufacturers cannot operate by "guesswork," neither can the farmer. "In almost every other business," he maintained, "regular accounts are deemed necessary to the proper conducting of its affairs."¹²

Along with accounting methods, time management also became a much discussed topic. Southern reformers again looked to other enterprises for examples of how best to run a plantation. An Alabama planter complained that "the merchant, the banker, the mechanic and the manufacturer, all have defined hours of labor and business," while the planter has left his operations to "chance and circumstances." He suggested better time management with a "signal, at a prescribed hour . . . for rising" and another "for starting to . . . work." By clock management, he concluded, a planter could ensure "uniformity and system" of labor.¹³

Many planters and farmers took time management seriously. They incorporated a modern view of time that resembled that of railroad and

¹²"Plantation Register and Account Books," Southern Cultivator 12 (February 1854): 55; "Farm Accounts," Southern Cultivator 12 (January 1854): 31; "Farm Book-keeping," Southern Cultivator 13 (February 1855): 54.

¹³ "Plantation Regulations," The Soil of the South 1 (February 1851).

factory managers into their plantation rules.¹⁴ "It is strictly required," one reformer wrote, that "the manager . . . rise at dawn of day every morning; that he blow a horn assembling of the hands" and require the hands to be in place "in ten minutes after the blowing of the horn." James Tait, an Alabama planter, blew "the horn at sunrise for the negroes to start to work-- To make them get off quick after the horn is blown, always whip the last one out." Tait also timed lunch and dinner meticulously.¹⁵ A Louisiana planter commented that time management and accurate record keeping of all facets of the farm's operations was superior to intuition and memory. "When a farmer rises in the morning," he advised, "he should know precisely the whole work of the day." In fact, he added, he should inform his workers the night before of the next day's operations. The planter concluded his remarks with a jeremiad: "Without system, no man should enter upon a farmer's life; without system he will not, cannot succeed; . . . unless system guides every project and order presides over every department of his farm."¹⁶

¹⁴See especially, Smith, Mastered by the Clock, 69-92; Gutman, "Work, Culture, and Society," 551-557.

¹⁵"Management of Negroes," De Bow's Review 14 (February 1853): 177; James A. Tait Diary, November 15, 1852, Box 1, Folder 8, in Tait Family Papers, Auburn University Archives, Auburn, Alabama.

¹⁶ "System in Farming," Southern Cultivator 7 (June 1849): 82-83: On the importance of time see especially, Smith, Mastered by the Clock, 69-92; Gutman, "Work, Culture, and Society," 551-557; and E. P. Thompson, "Time, Work-Discipline, and Industrial Capitalism," Past and Present, 38 (1967): 56-97.

Most agricultural reformers agreed. A common refrain, as expressed by one reformer, was that plantation management required "uniformity in government" that included rules and a labor hierarchy comparable to "military government." Rules and regulations should control laborers' time, responsibilities, and work habits. If managed properly, a plantation could "move off like clockwork" and the labor operated with "uniformity and system."¹⁷ For this reason, the Southern Planter stressed that "good management consists not only in providing work for your laborers but in the manner in which the laborers themselves are controlled." The journal criticized faulty plantation management in the South "arising either from ignorance or want of system." A plantation required strict rules "calculated to command and control others" and to provide "system, order, and management."¹⁸

As a result of the trend toward a bureaucratic system, rules and regulations on some plantations resembled those of a military, railroad, or factory organization. Reformers often argued that a plantation needed to be broken down into departments with specialized jobs and tasks.¹⁹ "In the

¹⁷Soil of the South 1 (February 1851).

¹⁸"Slavery," Southern Planter 1 (September 1841): 157.

¹⁹Oakes, The Ruling Race, 153-160; Fogel and Engerman, Time on the Cross, 184-209; Chandler, The Visible Hand, 64-67; Aufhauser, "Slavery and Scientific Management," 816-820; Metzger, "Rational Management," 123-126.

different departments on the plantation," wrote one contributor to the Southern Cultivator, "as much distinction and separation are kept up as possible, with a view to create responsibility." The writer maintained that a plantation should be divided into separate departments, each with an overseer responsible for "subordinate persons."²⁰ For managerial control of slaves, Joseph Acklin added, a planter had "to establish some accountability amongst the negroes" with each having "special assignments." With this method, the planter or overseer could control his labor because he knew who was responsible for specific tasks.²¹

P. C. Weston of South Carolina also held many of these views of system and control. He outlined a bureaucratic structure of labor management that assigned every slave a specific job. Under the white overseer, the slave drivers were responsible for "discipline and order." They rang the morning bell and ensured that the other slaves got up and to work. Slave drivers also held responsibility for the "proper performance of tasks," and they inspected and approved all work. Weston outlined the different jobs on the plantation, including watchmen, truck-minders, nurses, cooks, and house slaves. In Weston's view, a labor hierarchy and job specialization

²⁰"Mgmt. of Slaves," Southern Cultivator 4 (March 1846): 44.

²¹"Rules in the Management of a Southern Estate," De Bow's Review 22 (April 1857): 380.

created system and accountability.²² Such arrangements, if not commonplace, existed on many plantations. An observer of Governor George McDuffie's cotton plantation discovered a similar bureaucratic structure for field hands. There, he found laborers divided into separate classes: "1st, the best hands, embracing those of good judgement and quick motion. 2d, Those of the weakest and most inefficient class. 3d, the second class of hoe hands." The observer noted that the "classified" positions created an efficient and well-organized labor system.²³

Despite the reformers' ideals, and their adoption of many, a large number of plantations did not run efficiently. Within the bureaucratic system of plantation management, the position of overseer posed a significant problem. Overseers were caught between the demand for high yields and proper treatment of slaves. Unfortunately, slaves suffered the brunt of this contradiction.²⁴ Plantation owners bitterly complained that overseers were uneducated, did not properly care for the slaves, and did not

²²"Management of a Southern Plantation," De Bow's Review 22 (January 1857): 42-43.

²³"Governor McDuffie's Cotton Plantation," De Bow's Review 6 (August 1848): 149-150; See also, Charles G. Steffen, "In Search of the Good Overseer: The Failure of the Agricultural Reform Movement in Lowcountry South Carolina, 1821-1834," Journal of Southern History 63 (November 1997): 753-802.

²⁴James O. Breeden, Advice Among Masters: The Ideal in Slave Management in the Old South (Westport, Connecticut: Greenwood Press, 1980), 291.

run a plantation efficiently. These complaints prompted reformers to suggest that overseers become a tightly controlled part of the plantation organization. Regulations for the proper system of plantation management were interwoven with rules to control middle management.

The problems posed by the ineptitude and brutality of overseers could be solved, reformers believed, by written rules to control abuse and provide for systematic management. Andrew Flynn, a Yazoo-Mississippi Delta planter, developed rules based upon suggestions made in southern agricultural journals. The rules for overseers included the regular inspection of ditches, fences, implements, animals, and slave quarters every morning and night. All aspects of the plantation, Flynn maintained, should be kept in "minute detail" in an accounting book.²⁵ Another Mississippi planter amplified this advice: "The overseer shall keep a plantation book" in which he would record the health of the slaves, weather, and the condition of the crop. Moreover, he would "keep in it the weights of the daily picking of each hand; the mark, number and weight of each bale of cotton, and the time of sending the same to market."²⁶ Another reformer wrote, an overseer "should be orderly and systematic in everything; he

²⁵William Kauffman Scarborough, The Overseer: Plantation Management in the Old South (Baton Rouge: Louisiana State University, 1966), 68-70.

²⁶*Ibid.*, 71.

should have sense enough to make just and sensible regulations for the government of the negroes and firmness to execute them."²⁷

In addition to controlling the overseer, agricultural reformers stressed the proper treatment of slave labor, especially as sectional discord increased in the 1850s. They expected that set rules and bureaucratic control would create a more humane and rational working environment. They proposed more systematic and uniform management and punishment of slaves. As a result, rules for the behavior and actions of slaves resembled military, railroad, and factory regulations, with one critical exception: plantation rules required the "entire submission and obedience . . . on the part of every negro." Drinking, adultery, fighting, and trading were strictly forbidden.²⁸ "The negroes," Joseph Acklen wrote, "must be certainly punished for abusing the stock" and "losing their implements of work." Only by "strictly and rigidly adhering" to these rules could a plantation be run efficiently.²⁹

Physical force was employed to enforce these rules. Whipping was common. Southern agricultural reformers, however, even tried to make violence systematic. "Never punish a negro when in a passion," advised an

²⁷Townes, James M. "To a Young Friend" Southern Cultivator (1847) quoted in Breeden, Advice Among Masters, 298.

²⁸"Rules in the Management of a Southern Estate," De Bow's Review 22 (April 1857): 378.

²⁹"Rules in the Management of a Southern Estate," De Bow's Review 21 (December 1856): 617.

Alabama planter, because "no one is capable of properly regulating the punishment for an offense when angry." In other words, to run a plantation rationally and systematically, a slaveholder needed to avoid emotional excesses. Planters should "always attempt to govern by reason . . . and resort to force only when reason fails." If whipping took place, the owner should clearly state the offense to the slave and "never . . . leave the impression . . . you take pleasure in his punishment." In this way, punishment could become "a regular and systematic plan of operation" on a well-run plantation.³⁰

Other slave holders agreed with this view of slave management. A Virginia planter wrote that "the management of negroes" should be done with "perfect uniformity of conduct toward them. . . . The best evidence of good management of slaves" he believed, "is the impartiality of treatment."³¹ James Tait lamented that he had not implemented rules to regulate his slaves earlier. "Oh! if I had adopted them 10 or 15 years ago," he wrote, "how vastly better for my interests, and for my negroes good." He believed that well-regulated and "properly treated" slaves will do more

³⁰"Management of Slaves," De Bow's Review 18 (June 1855): 717-718.

³¹"On the Management of Negroes. Addressed to the Farmers and Overseers of Virginia," Farmers' Register 1 (February 1834): 564-65.

work in 10 hours, than those that are pushed all the time, will do in 12 hours."³²

Clearly, then, southern agricultural reformers saw no contradiction between slavery and modern business practices. By the 1850s, they had succeeded in making the systematic management of plantations an ideal, if not a general reality. Southern agricultural reformers stressed new bureaucratic ideas: system, uniformity, accounting, time management, and labor control. They adopted the bureaucratic structures that developed simultaneously in northern industry and on railroads. In general, their approach to management differed little from that of northern factory owners or railroad managers. They embraced modernization and new organizational ideas, into which they integrated the "peculiar institution."

In accordance with their encouragement of systematic plantation management, southern reformers also highlighted the advantages of technology and machinery. The railroad, in their view, provided the first step in the transformation of the southern economy. De Bow's Review, for instance, observed that the "power of steam, and its application to the engine and to machinery" had accomplished in a few years what had taken "centuries before . . . to accomplish." In a similar fashion, A. G. Summer

³²James Tait Diary, March [?], 1850 and November 22, 1850, Box 1, Folder 8, Tait Family Papers, Auburn University Archives, Auburn, Alabama.

told the Southern Central Agricultural Society that "engines with life-throbbing pulsations, snort . . . ready to propel useful machinery." Southern farmers, he counselled, needed to adopt this new technology "to go on steadily in the work of improvement."³³ Southern reformers saw that technology, organization, and economic progress were interwoven.

Therefore, they implored farmers and planters to use scientific methods and new technology. They constantly chided "humbugs" who attacked "bookfarming" and "yankee" farm implements. That farming could be mastered by science and technology became part of the progressive ideal, and it was identified with an increasingly mechanized economy. One planter captured this point clearly when he compared the knowledge of running a plantation to the complex operations of running a railroad. "Place the levers of a locomotive in the hands of one who had never before seen the powerful machine," he wrote, "and instead of being able to run it with the speed of the wind," he will be sadly "puzzled." He also compared knowledge of farming to a textile factory. "What could a plowman do if required to supervise a cotton factory?" He argued that farmers and planters needed the same expertise and knowledge of technology required of railroad

³³"Commercial Spirit at the South," De Bow's Review 2 (September 1846): 122; "Anniversary Address delivered before the Southern Central Agricultural Society, Macon, Georgia, October 4, 1852, by A. G. Summer, of South Carolina," Steam Power Press of Chronicle & Sentinel, Augusta, Georgia, 1853.

engineers and cotton factory managers. He thereby related plantation management, not to old ideas, but to the new ideas of an industrializing society. A plantation, he maintained, had to be mastered like a machine. A machine or farm could not be run "without the knowledge of all its parts" nor a "mastery of facts and principles." He also asserted that Southerners needed more "yankee ingenuity" and to become "inventors of farm machines" who were "bold enough to lead" the South into the future.³⁴

The bonding of science and technology with the ideas of system and uniformity permeated southern agricultural literature in the late antebellum period. South Carolina's James Henry Hammond, for example, drew the connection between technology and the systematic management of a farm in an 1850 speech to the South Carolina Institute. "In the construction of machinery," he lectured, "it is necessary that its smallest parts should be as perfectly adapted as its largest . . . and the nicest care is necessary in keeping it in operation." In the same way, he concluded, southern farmers needed to oversee their farms and plantations with "thorough and systematic care on small matters, which is absolutely indispensable to successful husbandry."³⁵

³⁴ "Forces of the Farm," American Cotton Planter 1 (1853): 139-140.

³⁵ "Progress of Southern Industry. Governor Hammond's Address Before the South Carolina Institute, 1850," De Bow's Review 2 (June 1850): 506-507; For a fascinating study on how Hammond tried to implement systematic management and control on himself, his plantation, and his

By the 1840s and 1850s, technology and system had become inseparable in the minds of southern agricultural reformers. "The farmers [sic] objection to machinery," the Southern Planter warned "must be overcome. . . . The day has passed by when it was imagined that the comprehension of a farmer did not extend beyond a hoe or an axe." To compete, the Planter asserted, the farmer "must be a mechanic. He works with tools, and therefore, is a mechanic. Many of his operations are complicated, and may be facilitated by more or less of labor-saving machinery." The journal concluded that "farmers must . . . apply science to agriculture . . . by becoming thoroughly versed in . . . mechanical principles."³⁶ As they did in support of bureaucratic reforms, the reformers buttressed their arguments for technological advancement by citing railroads and factories as examples. "Since machinery has been applied, better roads, turnpikes, railroads . . . have been constructed." The "jenny" and the "loom," one wrote, had "trebled the production of many articles." Nevertheless, the writer lamented, "there have been less improvements in agricultural implements than in machinery for manufacturing purposes--

slaves, see Drew Gilpin Faust, James Henry Hammond and the Old South: A Design for Mastery (Baton Rouge: Louisiana State University Press, 1982), 69-134.

³⁶"Machinery," Southern Planter 1 (June 1841): 91-92.

but this is the age of improvement. Let machinery be applied to husbandry also."³⁷

A contributor to the Southern Cultivator agreed with these views of technological progress: "We go into our gin-houses, and, amidst the rumbling of wheels and the wheezing of bands" we look on "with pleasure." These machines, he observed, were created from "the principles of Mechanical Philosophy." These principles needed to be applied to "the system of agriculture." J. P. Benjamin drew the same conclusion. With "skill in cultivation, system in management, economy in administration, both agricultural and mechanical, and a judicious application of labor saving devices," the South could create "models of plantership."³⁸ As these examples demonstrate, southern agricultural reformers made a real connection between efficiency, systematic organization, and technology.

In addition to systematic management and technology, reformers also proposed scientific methods for planting and cultivation. They encouraged farms and plantations to incorporate the latest scientific findings in plowing, crop rotation, ditching, and in the use of fertilizer. In this campaign, they fought an uphill battle against traditional farming practices. Critics of

³⁷"Benefits of Machinery," Southern Planter 8 (December 1848): 367.

³⁸"Address Extracts," Southern Cultivator 4 (August 1846): 123; "J. P. Benjamin's Address on Agriculture," De Bow's Review 5 (January 1848): 44-45.

scientific agriculture deprecated what they called "book farming." Southern journals complained about "humbugs" and "old fogies" who refused to change their agricultural practices. One progressive farmer wrote: "I [am] determined to brook taunts and jeers, and in some measure, at least, turn 'book farmer.'" Southern agricultural journals encouraged this view of agriculture as a science, not an art. An article in one urged that "every department of the great business of farming is . . . that Agriculture is a Science" and a farmer should "attend the application of Hydraulics in Machinery . . . and chemistry" in the production of crops.³⁹

Southern reformers persisted in connecting the need for scientific agriculture with new technology and the changing economy. "Look to the other departments of human labor: Mechanics build bridges, steamboats, railroads and . . . spin textile materials," one exclaimed. They achieved these accomplishments with "chemistry and other sciences" and yet the "farmer turns away." Farmers, in other words, had to incorporate the ideas of science as other professionals did or they were doomed to "failure." This type of argument remained quite common. "The farmer," a Georgia farmer

³⁹"Plantation Management and Practice," American Cotton Planter and Soil of the South 12 (December 1857): 372; "Agriculture as a Science," American Cotton Planter and Soil of the South 12 (August 1857): 253; "Reasons why every Farmer should pursue his Business as a Science," Southern Cultivator 13 (January 1855): 19-20; See also, Carville Earle, "The Price of Precocity: Technical Choice and Ecological Constraint in the Cotton South, 1840-1890," Agricultural History 66 (3) (1992): 25-60.

observed, "in these days of steam and electricity, must not stand still." Indeed, he "must quit laughing at book farming." Another wrote that farmers must follow the "highest order" of the "mechanic arts" and use "new and improved methods" of business and science.⁴⁰

By the 1850s, southern agricultural reformers believed that modernization could take place in the South without challenging slavery. To modernize the southern economy, however, more than farms and plantations needed reform. They argued that schools needed to be changed and bureaucratized. Calls for scientific agriculture, the use of new technology, and the systematic management of farms and plantations prompted calls for educational reform. The introduction of the railroad and the expansion of commerce and trade became a justification for this reform. If Southerners desired economic progress accompanied by new technology, reformers argued, they needed better schools that taught science, engineering, and management. The reformers' links between technology, science, systematic management, and educational reform were quite clear. A contributor to the Southern Cultivator understood the nexus: "Our steamships, railroads, mines, foundries and machine shops require . . . inventive, executive and financial ability." Accordingly, the South needed

⁴⁰"Farmers, Dignify Your Profession," Southern Cultivator 17 (January 1859): 5; "A Word for Progressive Farming," Southern Cultivator 2 (March 1853): 78; "Agricultural Reading," Southern Cultivator 4 (October 1846): 154.

to provide the training ground, especially scientific education, to prepare Southerners for "professional life" and "the stirring occupations of the present day." In the same vein, an agricultural journal editor argued that the introduction of the railroad made educational reform a necessity. "Without an increase in popular knowledge," he wrote, "railroads will only facilitate the depletion of the soil, multiply old fields, and depopulate the State." Southern reformers clamored for better educational facilities. They thought the future of the South depended on it. They feared that the region would fall further behind the North economically without the institution of educational reforms.⁴¹

Educational reformers insisted that educational reform was essential to economic modernization. A. G. Summer told farmers at the Southern Central Agricultural Society meeting in Macon, Georgia, that a "system of education" ought to be devised that prepared students for "future occupations as Agriculturists and Mechanics, such a system would be the patent of undreamed of prosperity to our section of the Union." G. D. Mitchell emphasized the need for education in this "utilitarian age of . . . rapid progress." In his view, education in mathematics, engineering, and natural philosophy that taught "the phenomenon of force and motion,

⁴¹"Agricultural Colleges," Southern Cultivator 17 (September 1859): 258; "The Educational Wants of Georgia," Southern Cultivator 14 (July 1856): 205.

sound, light and heat, mechanical powers and their application, the available power of steam" had to be incorporated in a modern education along with the methods of "farm accounts, including precision, method and accuracy."⁴²

Reformers envisioned technical schools and agricultural colleges as the means to accelerate the South's technological and economic progress. J. V. Jones, a Georgia agricultural reformer, believed that the next generation of Southerners needed state agricultural schools to teach "the mechanic arts, for the education of men for practice [*sic*] life, instead of multiplying in an alarming degree the present school & college system which is demoralizing the largest number of youth" and producing only "professional diseases & vagabonds." He told Daniel Pratt, an industrialist who manufactured cotton gins in Alabama, and Bolling Hall, an Alabama agricultural and educational reformer, that mechanical education was "the sign of the times."⁴³

Jones was not alone. In response to the rise of the railroad and the factory system, interest in engineering education burgeoned in the South. The United States Military Academy became the model for scientific

⁴²Summer, "Anniversary Address," 1853; "Agricultural Education," Southern Cultivator 11 (October 1853): 307.

⁴³J. V. Jones, Atlanta to Mess. Bolling Hall, Daniel Pratt and Others. Executive Committee of the Autauga County Agl. Association, October 22, 1853, LPR 39, Box 4, Folder 3, in Bolling Hall Papers, Alabama Department of Archives and History, Montgomery, Alabama.

education. Southern reformers hoped the Virginia Military Institute would become the South's West Point.⁴⁴ Military schools grew in popularity in the South because they stressed engineering skills as well as military organization and discipline. A South Carolina educational journal, The Self Instructor, made explicit the connection between the growth of railroads and the need for military schools. "The complicated operations of a railroad company are not unlike the strategic movements of an army. . . ." Therefore, the article continued, it was in the South's "public interest to see that the highest talent of the country be developed, especially in the engineer department of the mechanical art, for upon the wisdom of her railroad operations does much of the South's chance for direct trade and commercial independence rest." To accomplish this end, the South had to "support our military schools as near as possible on the model of West Point, and there will be no want of mechanical talent and theoretical knowledge among our youth, to supply any demand we make."⁴⁵

John Whitford, a North Carolina planter and railroad builder, heard the same argument from fellow North Carolinians. Charles F. Fisher

⁴⁴Dan R. Frost, "A Confederate Education in the New South: Southern Academia and the Idea of Progress in the Nineteenth Century" (Ph.D. diss., Louisiana State University, 1994), 13-79.

⁴⁵"Railroads," The Self Instructor: A Monthly Journal. Devoted to Southern Education and to the Diffusion of a Knowledge of the Resources and Power of the South, as represented by The Negro. The Rail and the Press, I (November 1853): 39-40.

complained that the Western North Carolina Railroad Company had difficulty finding a qualified engineer. "Who is to take charge as Chief Officers," he observed, "is an undetermined & somewhat embarrassing question--you know how hard it is to find any competency--and our Western people have not been situated to learn much of the matters." Another correspondent, noting the importance of railroads to North Carolina's future, advocated better schools. "North Carolina wants a school of science as much as she does railroads," he explained. "I am determined she shall have one if I can bring it about."⁴⁶

Reformers saw engineering and technical education as a rational step in adapting to a changing economy. If the South adopted agricultural and educational reform, they believed, it would enjoy the fruits of economic change. If not, the South would fall further behind the industrializing North. Classical education, reformers were convinced, did not prepare the South for the future. An advocate of military schools in South Carolina made this clear: "The taste for literary pursuits, among the people of South Carolina, have made them conspicuous in the forum; but has it rendered us properly useful to ourselves, or independent of other States? Has it extended our commerce, improved our arts, or established our

⁴⁶Charles F. Fisher to John D. Whitford, August 31, 1855, Box 89.1, and Francis L. Hawks to John D. Whitford, March 3, 1855, in John D. Whitford Papers, North Carolina State Archives, Raleigh, North Carolina.

manufactures? Is South Carolina known, in the world, for her discoveries or her inventions? Are her natural resources yet developed?" To these questions, the writer gave a resounding "no." For that reason, he argued, the South had to change from an educational system based on literary pursuits to one based on science and technology. "A crisis, for the South, may be at hand," the writer warned. "Our present system has to be changed, and we must effect a commercial, productive, and manufacturing revolution, if no other." This step could only be taken if the South introduced schools that taught new technology and scientific methods.⁴⁷

Reformers remained adamant. Economic modernization, agricultural reform, and educational reform were all connected. They understood that economic modernization required change. They knew the next generation needed an appropriate education to prepare them for the administration of railroads, mines, factories, and plantations. "If we had a son who was to be an Engineer, a Miner, a Machinist, a Merchant or a Planter," one wrote, "his early training should be very different from that which we should give if he were to be a Lawyer, a Clergyman, or a Statesman." He explained that "special pursuits require special preparation.

⁴⁷"Military Schools of South-Carolina," Southern Quarterly Review 3 (November 1850): 527.

To put one of our sons, just out of a Classical Institution, to manage a Factory would be as unwise as to put him at once to manage--a plantation."⁴⁸

Although southern reformers expressed concerns over training the future generation for trades in industry, railroads, and commerce, the South remained an economy dominated by cotton. Most of the discussion surrounding educational reform, as a result, centered on the need for scientific agriculture. With expanding railroads and an international market, southern reformers looked for ways to train future farmers and plantation managers. They envisioned agricultural colleges that would teach science, technology, plantation organization, and military discipline. Edmund Ruffin, the South's leading spokesman for agricultural reform, presented his case for agricultural colleges in the American Cotton Planter. At college, Ruffin wrote, students should learn all the skills necessary for competent plantation management. Required subjects would include arithmetic, geometry, and chemistry. Along with these basics, students should study "mechanical hydrostatics and hydraulics," as well as "operative chemistry" that analyzed soils, manure, and crops.⁴⁹

⁴⁸ "Mr. Calhoun's Address, at the Carolina Fair," Southern Cultivator 18 (January 1860): 21.

⁴⁹ Edmund Ruffin, "On Agricultural Education," American Cotton Planter 1 (July 1853): 194.

In Ruffin's opinion, learning how to run a farm or plantation with system and uniformity was as important as knowledge of chemistry, botany, deep plowing, tillage, crop rotation, and the use of fertilizer. He strongly advocated teaching bureaucratic management. A student, he argued, should learn how to control labor and hold an overseer to "strict and unrimitting [sic] attention to his duties." Furthermore, he said, agricultural colleges needed to teach their students to run farms and plantations in such a way that "the discipline of the whole establishment should be strict, even to the degree of military precision." This military precision entailed tight labor control based on a strict hierarchy. In addition, students had to be trained in keeping a "regular journal" that allowed for "a systematic plan, of all the proceedings on the farm." Accounts should be kept of labor parties and their efficiency, as well as implements, machines, and agricultural experiments. If the South enacted his plan for agricultural education, Ruffin concluded, it would create "the best system of husbandry and general management" in the country.⁵⁰

The Soil of the South advocated the same ideas for agricultural education. It lamented that southern states had made no "provision in our system of education, for imparting instruction in agriculture." Planters, and especially overseers, needed to "be educated as farmers and managers of

⁵⁰*Ibid.*, 194-195.

slaves" and "regularly and systematically taught every thing necessary to an upright and enlightened performance of their duties." With agricultural education, they could manage a "hundred slaves, and conduct the complicated concerns of a large plantation." As so many others did, this southern journal connected educational and agricultural reform.⁵¹

Further, an agricultural education that taught systematic management also instilled in its students a bureaucratic mentality. Planters, as well as railroad engineers and factory managers, needed training in a military environment. The Self Instructor maintained that all state colleges needed "strictly military" discipline. Military education, the journal averred, provided students with the basics needed for "good management." In addition, military discipline "taught students to do systematically and for considerable spaces of time, that which though useful, is irksome and uninviting." In this way, military discipline combined personal control with systematic management. The journal argued that this combination provided students "the best methods of applying knowledge to the practical business of the farmers and planter."⁵²

⁵¹"Agricultural Science," The Soil of the South 3 (December 1853): 740-741.

⁵²"On Agricultural Schools," The Self Instructor 1 (February 1854): 106, 109, 107.

Even as reformers advanced grand views of educational modernization, they often complained about "old fogies" who did not understand the connection between education and economic modernization. The Soil of the South reprinted an editorial from the New England Cultivator that attacked "old fogies" who "shun railroads and steamboats as inventions of the devil, preferring to trust the old grey mare of their fathers, rather than foster modern enterprise." The southern editor recognized the same problem in the South. Old ideas had to be abandoned. The railroad, telegraph, steam power, and factory system made education a priority in reformers' eyes. It would, they believed, prepare future generations for a new economy through the extension of railroads, the expansion of industry, and the practice of scientific agriculture.⁵³

Educational reform also had another important aspect. As the railroads and plantations incorporated new bureaucratic structures, a modern state educational system would as well. Southerners debated the need for a modern educational system within the context of a stronger, bureaucratic state structure. Like their northern counterparts, reformers called for centralized state funding, uniform texts and curriculum, qualified

⁵³"Book Farming," The Soil of the South 4 (January 1854): 18; Robert E. Hunt, "Organizing a New South: Education Reformers in Ante-bellum Alabama, 1840-1860" (Ph.D. diss., University of Missouri-Columbia, 1988), 78-80.

teachers, and state control of local schools.⁵⁴ Southern journals criticized the lack of a school system in southern states. The Southern Quarterly Review reported that "the organization of our common schools has been faulty" with "imperfect and injudicious methods of teaching and discipline" and with teachers who "have not infrequently been sadly deficient in proper qualification." According to the journal, the major problem with southern education was the lack of uniformity and centralization.⁵⁵

To develop control and uniformity in public education, the journal suggested a bureaucratic structure of management. States, it suggested, should set up school districts with a board of directors that would supervise the uniformity of buildings, books, teaching methods, and discipline. With a district structure, the journal maintained, states could provide the order that "is indispensable in any well regulated system of schools established on the popular plan." It also insisted that the district system reflected the "age

⁵⁴Hunt, "Organizing a New South" 194; See also, Robert C. Reinders, "New England Influences on the Formation of Public Schools in New Orleans," Journal of Southern History 30 (May 1964): 181-195; Albert Fishlow, "Levels of Nineteenth-Century American Investment in Education," Journal of Economic History 26 (December 1966): 418-436; Alexander James Field, "Economic and Demographic Determinants of Educational Commitment: Massachusetts, 1855," Journal of Economic History 39 (June 1979): 439-460; Michael B. Katz, "From Voluntarism to Bureaucracy in American Education," Sociology of Education 44 (Summer 1971): 297-332.

⁵⁵"System of Common Schools," Southern Quarterly Review 6 (October 1844): 461-462.

and state of progress" occurring in the economy and society. Further, it compared the present system to a piece of broken machinery: the "system . . . like the model of a steam engine on paper, unpropelled by the life-imparting element, or like the engine itself, which has lost itself, which has lost its propelling power by the bursting of its boiler."⁵⁶ Education in the South, in other words, failed because it lacked system and uniformity. Machinery, again, provided a metaphor for a well-organized and orderly society, and in this case, an educational system. The Southern Planter also decried the need for an updated system in public education. It used West Point as an example. Like the military academy, public schools required uniformity and control. "Order and regularity" the article averred, "are the presiding principles of system."⁵⁷

De Bow's Review shared this opinion. It outlined a bureaucratic state school system headed by a superintendent of public education. The superintendent would oversee each county's school commissioner. In turn, each commissioner would supervise three trustees from each township. As a quality control mechanism, every county would have several inspectors in each school district to ensure the enforcement of uniform standards. Feedback contributed an important part of the system. Teachers would

⁵⁶Ibid., 460-464.

⁵⁷"Education," Southern Planter 5 (March 1845): 49.

provide monthly reports on prescribed forms to the State Board of Education. The reports would include attendance, deportment, diligence, and learning progress for each student.⁵⁸

At the end of each year, according to De Bow's plan, the county commissioners would convey, along with the reports of the inspectors, the "condition of the Schools and the working of the system." The State Board of Education would then review each of the counties' schools. After this review, the Superintendent would report to the state legislature. The Board would also examine all prospective teachers in the state as well as oversee the adoption of school texts. With this system, De Bow's argued, state schools could maintain talented teachers, uniformity of instruction, and education of the "highest order."⁵⁹ Not surprisingly, the journal proposed a state school system with many of the ideas found in a modern bureaucracy: control mechanisms, rules and regulations, information feedback, and a managerial hierarchy.

Although most southern states took only halting steps toward reform, North Carolina, Alabama, Tennessee, and Texas made significant strides

⁵⁸"Sketch of a Public School System for a State," De Bow's Review 3 (January 1847): 80-81; Beniger, The Control Revolution, 174-177.

⁵⁹Ibid., 83.

toward creating state school systems.⁶⁰ In 1854, Alabama passed a school reform law that centralized power in the hands of a state superintendent. Its system followed closely that outlined in De Bow's Review. A state superintendent oversaw county commissioners who controlled the administration at the local level. The commissioners regulated the schools and supervised local teachers. Alabama reformers believed a strong superintendent system would lead to uniformity in the hiring of trained teachers rather than the wide variations of competence found at the local level. Further, standardization of curriculum and textbooks allowed for control and accountability over what students learned. Finally, the Alabama system taught students discipline and self control.⁶¹

In many ways, Alabama's school reform act foreshadowed the industrialized and bureaucratic South that emerged during and after the Civil War. Educational reformers in the state reacted to the technological and economic changes occurring in the 1850s. They wanted a professional school system to create well-educated persons to advance scientific farming, railroads, and industry. Indeed, educational reform in Alabama occurred along with rapid growth in railroads, manufacturing, mining, and a resurgence in agricultural reform. State school system advocates saw

⁶⁰Fishlow, "Levels of Nineteenth-Century American Investment," 418.

⁶¹Hunt, "Organizing a New South," 51, 67-76.

themselves as part of a larger movement in the economy and society. Educated Southerners, reformers argued, would generate the inventive power to build telegraphs, railroads, and steamships.⁶² They proposed a bureaucratic system of education that stressed the same principles of standardization, uniformity, control, and discipline operative on railroads and on plantations. In other words, they reordered the education and built new institutions to prepare students for a mechanized, industrialized, and organized economy. In essence, southern agricultural reformers, educational reformers, and railroad managers became part of the same organizational process.⁶³

The formation of agricultural and commercial organizations in the 1840s and 1850s offered another important manifestation of the spread of an organizational mentality among southerners. Increasing railroad mileage, commercial expansion, and sectional discord contributed to the proliferation of these organizations. Planters and farmers realized that the introduction and growth of the railroad had promoted the expansion of the cotton market. They also knew that they had little control over the price of cotton or railroad rates. Consequently, calls for some form of organizational control of the market intensified as railroad mileage spread. These

⁶²Ibid., 16-17, 67-78, 103; Thornton, Politics and Power in a Slave Society, 291-305.

⁶³Hunt, "Organizing a New South," 245.

reformers believed that through organization they could take advantage of an expanding market.⁶⁴

Market expansion changed the position of the individual farmer and planter because of the complex nature of the economy. Some southerners realized this change required an organized response to maintain their position of power in the economy. "Union," the Southern Planter blared in its first volume in 1841, "is the guardian spirit of our institutions." Farmers lagged behind other trades and professions, the journal complained, because they remained unorganized. Without organization, it warned, farmers would be relegated to second-class citizens. "All classes but the agricultural have felt the benefit of united action" and the time had come for farmers to form "agricultural societies."⁶⁵

Southern agricultural associations had two goals: individual improvement and collective power. Agricultural organizations emphasized the need for scientific agriculture and efficient management of labor. As the Southern Cultivator stated clearly, "the object of these associations is to bring the farmers together, [and] compare their views on matters of deep

⁶⁴See especially, Faust, "The Rhetoric and Ritual of Agriculture," 541-568; James C. Bonner, "Genesis of Agricultural Reform in the Cotton Belt," Journal of Southern History 9 (November 1943): 475-500.

⁶⁵"Association," Southern Planter 1 (October 1841): 188; See also, Charles Sellers, The Market Revolution: Jacksonian America, 1815-1846 (New York: Oxford University Press, 1991).

practical interest to them." In this way, farmers might "secure an improved system of operations." The idea of individual improvement through organized action ran through much of the literature. John C. Calhoun noted agricultural societies that published scientific findings, journals, and papers would enhance agricultural progress by disseminating valuable information to planters and farmers. Furthermore, by helping to improve planting techniques they would raise farming to the state of a profession. Professionalization of farming became a key idea behind agricultural organization. "Nothing great and valuable has been achieved in the world without an association," stated the Southern Cultivator. Unlike "military men, lawyers and physicians," it observed, farmers failed to professionalize themselves.⁶⁶

Besides the advocacy of farming as a profession, agricultural associations emphasized reform. Their meetings, mainly led by the southern elite, promoted railroads and educational reform as well as agricultural techniques such as ditching, crop rotation, and the use of fertilizer. Reformers lamented the practice among many farmers of destroying the soil and then moving to the more fertile lands of the

⁶⁶"Agricultural Societies," Southern Cultivator 7 (November 1849): 171; "Address by John C. Calhoun before Barbour County Agricultural Society on December 26, 1846," Southern Cultivator 5 (May 1847): 76-77; "Farmer's Clubs and Associations," Southern Cultivator 8 (August 1850): 120.

southwest. They proffered a combination of agricultural societies, railroad development, and agricultural education as a means to create more efficient farming. At agricultural association meetings, they awarded prizes for the best cotton crop and best managed plantation, and gave medals for the best farm equipment such as cotton gins, plows, and other machinery. Farms with efficient management served as models. The associations did whatever they could to promote progressive agricultural techniques.⁶⁷

In the vortex of railroad development, internal improvements, the growing power of state governments, and northern criticism of slavery, antebellum agricultural reformers emphasized the need for more improvement of individual farms. They also stressed the necessity for organized control of the market. De Bow's Review and other southern agricultural journals led the call for commercial and cotton growers conventions to control cotton prices. De Bow's demonstrated that "isolated" farmers had no economic power without "concentration" and "uniformity of action."⁶⁸

⁶⁷Faust, "The Rhetoric and Ritual of Agriculture," 541-568; See also, Carville Earle, "The Myth of the Southern Soil Miner: Macrohistory, Agricultural Innovation, and Environmental Change," chap. in Geographical Inquiry and American Historical Problems (Stanford: Stanford University Press, 1992), 258-299.

⁶⁸"Agricultural and Manufacturing Prospects of the South and West," De Bow's Review 1 (March 1846): 237.

Southern reformers feared that if southern planters and farmers did not organize they would be crushed by northern and European industry. At first, they called for industrial and agricultural diversification. Subsequently, they proposed market controls over the price of cotton. If planters organized, they reasoned, they could set the minimum cotton price. Indeed, this idea animated Cotton Planters Conventions in the 1850s. William Terrel told the Cotton Planters Convention of Alabama, for example, that "our adversaries herd in the public marts . . . they combine. . . . They estimate our productions, and, too often, regulate the prices upon data made for the occasion." It followed, then, that cotton planters needed to gather statistics on the control of their own crop and wrest it from the hands of speculators.⁶⁹

Shortly thereafter, another convention outlined greater measures of cotton control. It demanded the formation of "a mammoth combination of cotton planters" that would guarantee planters a "fair price . . . under any and all circumstances, and without regard to the ruling rates in Europe."⁷⁰ As an organized entity, reformers believed, cotton planters would control the amount, the manufacture, and the marketing of cotton.⁷¹ The Southern

⁶⁹"The Central Agricultural Society, To the Cotton Planters' Convention of Alabama," The Soil of the South 2 (July 1852): 289-290.

⁷⁰Montgomery Advertiser 28 October 1851.

⁷¹Ibid., 20 April 1852.

Cultivator added that, "such a system as this would protect us against the consequences of irregular production, but it could never be carried into effect by individual action." Only a Cotton Planters Association could set up warehouses, commission merchants, insurance, interest on investment, and control purchases and sales.⁷²

Reformers also discussed the idea of direct trade with Europe. They encouraged bypassing northern factors and textile mills. De Bow's Review explored this idea in a series of articles. This proposal became a staple issue at conventions throughout the 1850s. Southern states would develop steamship lines tied to southern railroads at Charleston, Savannah, and New Orleans, while planters would build warehouses for their cotton. By controlling transportation and storage, as well as production, southern planters would thereby guarantee a profit on cotton.⁷³

These dreams, however, never gained much influence or power. As one critic noted, "'A Cotton Planters' Convention,' for South! Nonsense, humbug! No more of this praying to Hercules. . . . Think ye a Cotton Planters' Convention would make the world plant less Cotton. Nonesense!

⁷²"Cotton Planters' Convention" Southern Cultivator 9 (September 1851): 140; See especially, Harold D. Woodman, King Cotton and His Retainers: Financing and Marketing the Cotton Crop of the South, 1800-1925 (Columbia: University of South Carolina Press, 1968), 139-153.

⁷³"Cotton, and the only practical methods presented to its producers of advancing and controlling its price," De Bow's Review 7 (July 1849): 49-51.

One man can lead a horse to water, but two can't make him drink." The editor of the *Montgomery Advertiser* expressed skepticism as well. He believed the regulation of cotton prices was a "chimerical idea."⁷⁴ These critics were justified. The rhetoric on the cotton market produced little real control. Still, it reflected the emergence of an organizational mentality in the antebellum South.

Indeed, southern reformers, attitudes toward modernization differed little from their northern counterparts. They encouraged bureaucratic management of plantations, scientific agriculture, and the use of new technology. They pursued educational reform based on scientific and technical instruction. They incorporated new bureaucratic structures of system, uniformity, and centralized control in their educational reform efforts. And, reformers discussed the need for organization of the cotton market. In sum, Southern reformers had the same outlook toward modernization as railroad managers and factory managers. They based their reforms on technology, system, bureaucratic control, and the "visible hand" of management. Like Isham Howze, reformers believed the South had to embrace the changing world.

⁷⁴"A talk about Agriculture," *Southern Cultivator* 7 (March 1849): 41; *Montgomery Advertiser* 28 October 1851.

CHAPTER 3

ORGANIZING FOR WAR: SOUTHERN RAILROAD MANAGEMENT DURING THE CIVIL WAR

On the eve of the Civil War, many Southerners had already embraced the new industrial ideas of system, uniformity, and bureaucratic control and applied them to railroads, plantations, and educational reform. Modern war, however, required system and organization on a much larger scale. Technology and organization would have a significant role the war's outcome. Railroads played a key part in the organization and mobilization of the war effort. A debate occurred, however, over who should control the railroad system. Railroads were already built, had rudimentary bureaucratic structures, and for the most part were in the hands of private corporations. Railroad managers believed they understood bureaucratic operations better than the military and resisted the idea of centralized control by the government. For much of the war, those who thought railroad companies could best manage themselves struggled against those who argued that the

government should centralize control. The Confederacy never resolved the dispute.¹

In the spring of 1861, southern railroads enjoyed both profits and growth. Railroad mileage had grown to close to 9,000 miles, and efficiency increased as lines adopted bureaucratic methods of management. The Memphis and Charleston crowed that it had never operated with greater "economy and efficiency" and the "degree of perfection" could "rarely be found on any road. . . ." The line stretched 271 miles, controlled 50 locomotives and 805 cars. The Mobile and Ohio laid its last bar of iron--which completed its connection to the Ohio River--as artillery fire echoed over Charleston. Southern railroad managers saw the future as bright, and

¹The most important work on Confederate railroads remains Robert C. Black, III, The Railroads of the Confederacy, with a Foreword by Gary W. Gallagher (Chapel Hill: The University of North Carolina Press, 1998); Other important works include Charles W. Ramsdell, "The Confederate Government and the Railroads," American Historical Review 22 (July 1917): 794-810; Robert C. Black, "The Railroads of Georgia in the Confederate War Effort," Journal of Southern History, 13 (November 1947), 511-534; Angus James Johnston, II, Virginia Railroads in the Civil War (Chapel Hill: The University of North Carolina Press, 1961); George Edgar Turner, Victory Rode the Rails: The Strategic Place of the Railroads in the Civil War (Indianapolis: Bobbs-Merrill, 1953). For a recent work that examines the Confederate government's role in interlinking railroads, see Scott Nelson, "The Confederacy Serves the Southern: The Construction of the Southern Railway Network, 1861-65," Civil War History, 41, no. 3 (1995), 227-243; For an excellent analysis of the North Carolina Railroad during the war, see Allen W. Trelease, The North Carolina Railroad, 1849-1871, and the Modernization of North Carolina (Chapel Hill: The University of North Carolina, 1994). For a good overview of southern logistics during the Civil War see Richard D. Goff, Confederate Supply (Durham: Duke University Press, 1969).

many lines planned further expansion.² But as President Samuel Tate of the Memphis and Charleston observed, a "civil war on a gigantic scale" had begun "disturbing and totally changing the entire character of the trade and commerce of the country . . . and entirely changing the nature and character" of railroad operations.³ Tate did not overstate the change in the scope of business or the character of the war. Despite the emergence of bureaucratic ideas and methods on southern railroads, the South now had to organize them effectively for war.

The most advanced bureaucratic system in the South before the war--railroads--deteriorated and declined in efficiency during the long and destructive conflict. First, the South did not have enough completed railroad mileage, and significant gaps remained in the system. Different gauged track and lack of connecting roads also created problems. Second, the South faced an ever increasing shortage of rolling stock and iron rail. The primary cause for the shortcomings of southern railroads, however, became the lack of efficient and centralized, bureaucratic control. The Confederate government did not implement on a larger scale the bureaucratic lessons

²Eleventh Annual Report of the Board of Directors to the Stockholders in the Memphis and Charleston Railroad Co. (Memphis, Tenn., 1861), 13; Proceedings of the Thirteenth Annual Meeting of the Stockholders of the Mobile & Ohio Rail Road Company (Mobile, Ala., 1861), 3; Black, "Railroads of Georgia," 511.

³Eleventh Annual Report of the Board of Directors to the Stockholders in the Memphis and Charleston Railroad Co. (Memphis, Tenn., 1861), 9.

learned by the railroad managers during the antebellum period. It never put the railroads under centralized control or enforced cooperation among different railroad companies. This lack of coordination led to significant difficulties.⁴

The influence of railroads on warfare can hardly be overstated. Southern railroad managers understood their importance to the war effort. The East Tennessee and Georgia, for example, adopted a resolution that proclaimed: "A new era has arisen in the history of Railroads-- demonstrating most fully the important and essential . . . [of] their purposes in advancing the interests of the country in times of peace," but more importantly it continued "their capacity for usefulness is still more obvious and potential for defence and security in war." The resolution went on to assert that the war "presented itself to test the efficiency of Railroads as one of the most powerful instrumentalities both in inflicting injury upon the enemy and protecting and rescuing our friends." Southern railroads also pledged their patriotism to the cause. "Of one thing . . . we can speak with confidence," the Mobile and Ohio Railroad president told stockholders, "your road, running through four States, will furnish in times of peace a great artery of commerce and in war a powerful arm of defence."⁵

⁴Black, Railroads of the Confederacy, 294; Ramsdell, "Confederate Government and the Railroads," 796-797.

⁵Proceedings of the Annual Convention of Stockholders in the East Tennessee & Georgia Rail Road Company (Knoxville, Tenn., 1861), 4-5;

As early as April 25, 1861, P. V. Danial, the President of the Richmond, Fredericksburg and Potomac Railroad, wrote Major General Robert E. Lee with suggestions on how railroads could help the war effort while maintaining efficiency, system, and control. First, he explained, unneeded cars should be moved off lines in order to use the road more efficiently. Second, every important terminal needed to have a locomotive ready at "a minute's warning" to move troops and munitions. It should be fueled with both wood and water and an engineer and fireman on constant duty. Third, every railroad should have an armed watch to guard tracks, bridges, and culverts that could be sabotaged. Finally, the military needed to understand that railroads represented a new technology that required system and control and could not be run in an ad hoc fashion. "Safety to lives and the protection both of trains and roads from destruction by collisions," Danial explained to Lee, "make it imperatively necessary that all trains should be regulated in their speed and movements by no one except the conductors or engineers of such trains, in accordance with the regulations and time-tables of the company." "Disregard of this regulation will inevitably result in collisions," and therefore rules "cannot be too rigorously observed and enforced." Lee neither responded to this letter nor sent guards to protect the

Proceedings of the Thirteenth Annual Meeting of the Stockholders of the Mobile & Ohio Rail Road Company (Mobile, Ala., 1861), 4.

line. To their dismay, railroad leaders found that many military officers did not understand railroad management.⁶

As a further gesture of cooperation with the new government and the call to arms, a convention of southern railroad men met in Montgomery at the end of April 1861 to discuss a transportation plan. Some of the most important railroad presidents, Samuel Tate of the Memphis & Charleston, William Johnson of the Charlotte & South Carolina, and R. R. Cuyler of the Central of Georgia and Southwestern Georgia, attended. No one thought the war would last long; thus, they made no long-range plans. The railroad presidents and the Postmaster General of the Confederacy, John H. Reagan, set up mail contracts and service. For moving troops, the railroads and government adopted a fare of two cents a mile and half the local rate for military freight. That was it. No discussion of centralized control, logistical problems, or coordination took place. The die had been cast for future problems.⁷

⁶P. V. Daniel, Jr., President Richmond, Fredericksburg and Potomac R. Co. to Major-General Lee, April 25, 1861, Ser. 4, v. 1, 240-241; P. V. Daniel, Jr., to Hon. J. P. Benjamin, Secretary of War, November 10, 1861, Ser. 4, v. 1, 724-725, War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies (127 volumes; Washington, D. C., 1880-1901). Hereafter cited as Official Records.

⁷Danl. H. Cram, Secretary to Hon. L. P. Walker, Secretary of War, April 30, 1861, Official Records, Ser. 4, v. 1, 269; L. P. Walker to the Presidents of the Several Railroad Companies, April 25, 1861, Official Records, Ser. 4, v. 1, 238; Black, Railroads of the Confederacy, 52-56; Goff, Confederate Supply, 17.

By the summer of 1861, with soldiers and military supplies clogging southern railroads, it became clear that the earlier plan might be insufficient. In response, a second railroad meeting took place on July 19, 1861. To solve the logistical problems, railroad presidents announced that munitions and troops had top priority, even if it meant stopping or delaying civilian traffic. Their pledge, however, was an informal agreement with no mechanism for enforcement. Nevertheless, most railroads reported to stockholders that they followed this policy. The key problem, however, remained. Railroads lacked coordination among different lines and government bureaus. Southern railroads had made strides during the antebellum period in control and coordination of their own lines. National and regional coordination with other lines and a new government was another matter indeed. Railroad managers felt pressure from several directions. The Confederate government, state governments, field commanders, local quartermasters, the Ordnance department, and the Commissary department all made demands of the railroads. Of course, each saw their own needs as the top priority. As the war progressed, conflicts between railroad managers and the military heightened and became bitter.⁸

⁸Black, Railroads of the Confederacy, 56-63; Twenty-Seventh Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1861), 201; Nelson, "Confederacy Serves the Southern," 229-235; Angus J. Johnson, "Virginia Railroads in April 1861" Journal of Southern History 23 (August 1957): 314; For a very harsh view of the military's handling of the railroads, see Jeffrey N. Lash, Destroyer of the Iron Horse: General Joseph E. Johnson

Nevertheless, railroad companies lobbied against any government action and argued that men trained in such work should control each line. Their position ignored the fact that railroads required coordination of their movements on a larger scale than before the war. Individual control of railroads could not provide the flexibility needed for a coordinated transportation system. Railroad companies, for example, experienced endless difficulties with the interchange of cars and transshipment. Governor Joseph E. Brown pointed out this problem when he complained that the state-run Georgia Railroad lost cars answering government demands. "We have let the East Tennessee roads have the use of our cars and engines this summer," he complained, "and they have abused and broken them till we shall be very hard pressed for motive power and rolling-stock to do our winter's business." Brown asserted that "if we let our engines and cars go for further use off our road we shall very soon be obliged to suspend our own business." Brown may have overstated his case, but his complaints became common among railroad managers.⁹

In addition, the lack of an organized interchange system caused frequent delays as trains had to be unloaded and reloaded on different

and Confederate Rail Transport, 1861-1865 (Kent, Ohio: Kent State University Press, 1991).

⁹Joseph E. Brown to J. P. Benjamin, Secretary of War, October 2, 1861, Official Records, Ser. 1, v. 1, 646; Black, Railroads of the Confederacy, 63-74; Ramsdell, "Confederate Government and the Railroads," 797-798.

companies' cars. The lack of connections in several cities slowed movement to a crawl. Moreover, the shortage of laborers needed to load the massive amounts of military supplies added to logistical problems. It was not unusual for supplies, troops, and passengers to sit for days or weeks waiting transshipment.¹⁰

In addition to a lack of coordination and control, railroad companies faced numerous additional difficulties. The transport of cotton fell because the Confederate government imposed regulations that ended free export of the crop. The amount of cotton shipped declined. The Southwestern Georgia reported that the government action and the federal blockade "discourage[d] the movement of cotton to the sea ports." In response, the railroad cut salaries by forty percent and suffered a loss of revenue. The Mobile and Ohio made a similar complaint. "Your Road," it averred, "running from a Blockade at Mobile to a blockade at the mouth of the Ohio meeting hostile fleets and armies at both points, has had its commercial connections broken. . . . The shipment of cotton, heretofore our source of income, has been entirely suspended." In the place of cotton, trains now moved troops and supplies. These shipments, however, usually traveled in

¹⁰Black, Railroads of the Confederacy, 63-74; Ramsdell, "Confederate Government and the Railroads," 797-798.

one direction and created inefficiency as only empty railroad cars made the return trip.¹¹

Further still, the unprecedented tonnage on southern lines created maintenance problems. Track, locomotives, and rolling stock suffered a higher than average pounding. During the first year of the war most railroads reported that they could meet these maintenance needs with supplies on hand. Many continued their prewar maintenance programs. The East Tennessee & Georgia, for example, replaced 30,000 cross ties in 1861. The Charlotte and South Carolina purchased new T-rail, a new locomotive, and continued to grade and track 25 miles of new road. The Seaboard and Roanoke reported that "a regular system of gravelling has been introduced" and "several miles had been done during the year." The Central of Georgia declared its track in good condition during the first year of the conflict. On hand, it had 390 tons of rail and 475 tons rerolled. The Central also reported, ominously, that its car and machine shops had been used to produce materials for the Confederate government, mainly munitions, and had not made any new engines or cars. Railroad managers warned that supplies would soon run out and that iron, machinery, locomotives, rolling stock,

¹¹Fourteenth Annual Report. South-Western Railroad Company (Macon, Ga., 1861), 400; Fourteenth Annual Meeting of the Stock-holders of the Mobile and Ohio Railroad Company (Mobile, Ala., 1862), 1-2; Black, Railroads of the Confederacy, 80.

spikes, and even cord wood and wood for trestles, would become scarce. By 1862, railroads began to feel the pinch of these shortages.¹²

In October 1861, railroad representatives again met to discuss their problems. The Chattanooga meeting did not focus on logistical problems but instead on financial difficulties. Southern railroads wanted a more remunerative rate for transporting troops and supplies. The Central of Georgia complained that profits would have been much higher if the government paid the market rate. In response, the government set higher rates in December and made them uniform for all carriers. The rates were divided by class: livestock, stock feed, ammunition, and miscellaneous. Livestock now had a fixed rate of \$20 per car load and \$15 for feed. The transport of ammunition cost 45 cents per hundred rate per hundred miles. All other government freight would be charged 20 cents per hundred miles. Importantly, the local rate included no reduction in price for government shipments. This last point greatly increased the cost of government shipping, especially when inflation spiraled out of control and local rates

¹²Proceedings of the Annual Convention of Stockholders in the East Tennessee & Georgia Rail Road Company (Knoxville, Tenn., 1861), 9; Thirteenth Annual Report of the President and Directors to the Stockholders of the Seaboard and Roanoke Railroad Company (Portsmouth, Va., 1861), 11; Twenty-Seventh Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1861), 202-203; Black, Railroads of the Confederacy, 80; Ramsdell, "Confederate Government and the Railroads," 798-799.

rose dramatically. Although it gained concessions in price, the Chattanooga meeting did nothing to clear up the problems of coordination and control.¹³

The burden of trying to get government troops and supplies moved efficiently fell predominantly on the Quartermasters' Department. It, however, did not have enough power to regulate the railroads. At the same time, Southern railroads faced a crisis in control.¹⁴ They needed centralized management with a bureaucratic structure. Railroad managers understood this challenge, but a debate raged over how to solve the problem. In January 1862, William Goodman, President of the Mississippi and Central, suggested to Jefferson Davis that the Confederate Government take a larger role in coordinating transportation. "The more reflection I give the subject," he wrote, "the better am I satisfied that written contracts should be entered into with the several railroad companies of the Confederacy for the transportation of Government troops, munitions of war, and supplies." These contracts should stipulate the price and "Government trains should run day and night." The government should also own its own freight cars

¹³Twenty-Seventh Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1861), 201; Black, Railroads of the Confederacy, 81-82; Ramsdell, "Confederate Government and the Railroads," 796.

¹⁴James R. Beniger, The Control Revolution: Technological and Economic Origins of the Information Society (Cambridge: Harvard University Press, 1986), 248-255; Alfred D. Chandler, The Visible Hand: The Managerial Revolution in American Business (Cambridge: Harvard University Press, 1977), 104-121; Black, Railroads of the Confederacy, 95-96; Ramsdell, "Confederate Government and the Railroads," 798.

and it should also assign "general freight agents . . . in different sections of the Confederacy as superintendents of Government transportation, and to see that the conditions of the contracts were complied with, and that these general agents should have the power to select messengers to travel with Government trains to prevent delays and secure speedy delivery."

Goodman also proposed that the government consolidate and centralize railroad shops at the major terminals. He thought Savannah, Augusta, Atlanta, Huntsville, Nashville, and Amite City, Mississippi, would serve these purposes well. In addition, Goodman encouraged the use of the Tredegar Works and other shops for the rerolling of iron. He thought that at the next railroad convention these ideas be addressed and "some method" of providing supplies and resources created.¹⁵

Despite Goodman's suggestions, the Confederate government refused to take such action. Quartermaster General Abraham Myers adopted a conservative position toward control of the railroads and argued that most railroad presidents opposed the idea. In response to Goodman's letter, Myers defended the present railroad system. He claimed that "every possible arrangement has been adopted to secure prompt transportation of public stores, and to this end many of the railroads have been employed to their utmost capacity." Delays had occurred but, he asserted, "no arrangements

¹⁵W. Goodman to Hon. Jeff. Davis, President Confederate States of America, January 25, 1862, Official Records, Ser. 4, v. 1, 880-882.

can be made so complete as to entirely prevent their recurrency." He went on to argue that government interference would destroy each railroads' bureaucratic system and control. "Government freight agents," Myers believed, "would interfere seriously with the management of details, which should be left entirely to the control of trained and experienced railroad employès." As for the payment system, Myers contended that it worked effectively. He closed his letter by noting that the department welcomed ideas and was "looking to the adoption of a system which will secure more complete, prompt, and economical transportation. . . ." Myers did not think the government would do a better job at running the railroads than the railroad companies themselves.¹⁶

The Confederate Congress would not hear of governmental control on constitutional grounds. It did not like the idea of centralized control because of qualms over the sanctity of private property, states' rights, and a fear of centralized government power--in other words, the ideals for which Southerners asserted they fought. A contradiction between these ideals and the requirements of modern warfare helped create paralysis when it came to the transportation system. Unlike other fields, such as ordnance production,

¹⁶A. C. Myers to Jefferson Davis, January 31, 1862, Official Records, Ser. 4, v. 1, 896-897; Goff, Confederate Supply, 40-41.

railroads had been in private hands before the war, and the government remained reluctant to assert control.¹⁷

By April 1862, however, some in the Confederate Congress believed that centralized control had become a necessity. William Boyce of South Carolina proposed a plan in the House Committee of Military Affairs to investigate whether government control might increase the efficiency of the railroads.¹⁸ In response, the committee developed an innovative plan for centralized control with a bureaucratic structure. First, the bill created a "military chief of railroad transportation," with a rank of Lieutenant Colonel, who would be selected from a southern railroad so that he would have the "judgement, skill, and experience in the practical details of railroad operations and machinery. . . ." The military chief of transportation would have the power to divide railroads into four separate military districts, under the supervision of a major. These superintendents would also be drawn from the field of railroad management. Moreover, the bill stipulated that all railroad managers would become military officers with the military

¹⁷ Goff, Confederate Supply, 40-41; Black, Railroads of the Confederacy, 63-70; On southern ideology and how it translated into government action, see George C. Rable, The Confederate Republic: A Revolution Against Politics (Chapel Hill: University of North Carolina Press, 1994).

¹⁸ William Boyce strongly supported centralization, especially when he was chairman of the Committee on Naval Affairs. When it came to the war effort he wanted "Audacity! Audacity! Audacity!" Ezra J. Warner and W. Buck Yearns, Biographical Register of the Confederate Congress (Baton Rouge: Louisiana State University Press, 1975), 27-28.

rank of captain. All other railroad personal would be given military ranks determined by their duties. Roadmasters, for example, would have the rank of first lieutenant. Thus, the bill created a centralized system with a bureaucratic hierarchy. This bureaucratic structure, however, was controlled by the very men who had built and understood railroad operations. The bill stated that "the officers herein named shall have complete and exclusive control, and be subject to no interference or control of any military officer of whatever rank, not engaged in the management of any railroad. . . ." Any interference would be considered a "military offense."¹⁹

These new military railroad officers would have the power to establish through schedules and oversee the interchange of cars in order to "insure, as far as practicable, their uninterrupted, safe, and prompt continuous transportation along their several railroads, without unnecessary delays. . . ." If a railroad refused or neglected to "conform to such schedules" the military superintendent would have the power to take "military possession" of the line and be "controlled and managed" by the military superintendent. The bill also gave authority to railroad officers for the impressment and movement of needed machinery, rails, water stations, or other structures deemed necessary. In this way, locomotives and rolling

¹⁹"A bill to provide for the safe and expeditious transportation of troops and munitions of war by railroads." v. 5, 251, Journal of the Congress of the Confederate States of America, 1861-1865 (7 volumes; Washington, D. C.: 1904-1905). Hereafter cited as Journal of the Congress.

stock could be moved from one line to another when needed. The company would be compensated by the government for the property. The House committee offered a far reaching plan that addressed many of the bureaucratic problems that southern railroads faced. Indeed, it allowed for the systematic control of time, speed, men, and machinery that this new technology required.²⁰

Its adoption might have led to centralized system that would have dramatically changed how southern railroads operated. It might have increased efficiency, control, coordination, communication, and maintenance. The plan most likely came from William M. Wadley, a noted railroad manager. Wadley had been superintendent of the Central of Georgia and other important southern railroads. He completely understood railroad management and bureaucratic control. But the full House rejected the plan. Many legislators believed that the bill was autocratic and put too much control in the hands of the military and government. Thus, although it provided an excellent blueprint, the plan was not implemented. The Quartermasters' Department also had come out against the bill and continued to try to control government shipments with no regulatory power. At the same time, logistics continued their nightmarish lack of coordination and tracks began to deteriorate.²¹

²⁰ Ibid., 252-253.

²¹ Ibid., 253; Black, Railroads of the Confederacy, 98; Goff, Confederate

In November 1862, Secretary of War Randolph tried to bring order to railroad operations without involving the legislature. He appointed Wadley as a colonel and assistant adjunct general in the Confederate Army. Wadley's orders stated that he was "to take supervision and control of the transportation for the Government on all the railroads in the Confederate States." He had the power to make contracts and agreements with the railroads. Nevertheless, Wadley had no real power and had to depend on the cooperation of individual railroads. Randolph hoped that Wadley, a railroad manager, could bring about this cooperation. Wadley wanted to create a system where railroad managers reported directly to him and submitted weekly reports. He also supported a through schedule for trains between Montgomery and Richmond. Unfortunately, Wadley had difficulty with both the railroad managers and with other government departments.²²

Both the Commissary Department and the Quartermasters Department complained about Wadley's appointment and argued that he only complicated matters. Quartermaster General Myers wrote Seddon a blistering letter. "The control of this important means of transportation," he argued, "has been one of the most responsible duties of this department,

Supply, 41; Curtis Arthur Amlund, Federalism in the Southern Confederacy (Washington, D. C.: Public Affairs Press, 1966), 65-79.

²²Randolph to R. E. Lee, November 14, 1862, Official Records, Ser. 1, v. 19, pt. 2, 716-717; Black, Railroads of the Confederacy, 109-110; Goff, Confederate Supply, 106; Ramsdell, "Confederate Government and the Railroads," 800.

mainly because of its intimate connection with the movements of our armies in the field. . . ." If control was taken away from the department, "much inconvenience, confusion, and embarrassment will result if their supervision be transferred to another department. . . ." He went on to say, however, that Wadley's competence as a railroad manager would be welcome within the Quartermasters' Department. Meaning, of course, that Wadley would have to report directly to him. Thus, Wadley's position remained ill-defined within the military's hierarchy, and his orders carried little weight.²³

Wadley immediately called for another railroad convention. He pursued three goals: cooperation in setting through train schedules, a system of freight-car interchange, and a revised tariff schedule. In his opening remarks, he told the assembled railroad presidents and superintendents that "with your cordial co-operation I am sure all difficulties will vanish, and without that co-operation I am equally certain that my appointment will be of no avail." He then laid out a general plan for the transshipment of cars and locomotives onto different railroad lines. He hoped that an organized system would "prevent cars from being scattered" and that rules for the interchange of cars would be "rigidly enforced." He set up three separate committees to address the issues.

²³ A. C. Myers to James A. Seddon, Secretary of War, December 9, 1862, Official Records, Ser. 4, v. 2, 231-232; Goff, Confederate Supply, 107.

Wadley thought a plan could be worked out. He then watched as railroad executives rejected his initiatives. Railroads jealously refused to pool their cars in an interchange system. They also demanded an increase in government freight rates. And finally, no through schedules were agreed to. Wadley left dismayed and dejected. He reported to Adjutant and Inspector General Cooper that the meeting "in my judgement failed to accomplish anything practicable. . . ." ²⁴

Nevertheless, Wadley knew better than anyone the plight of railroads due to maintenance problems, labor scarcity, and the myriad demands put on them. As for problems, Wadley asserted, "the first and most important is the disregard many army officers have for the private property of railroad companies." Army officers, Wadley asserted, order "rolling-stock from one road to another without making any effort or provision for returning it, or even without examining into the safety of the cars to run." Further still, the military acted too quickly to impress railroads. Wadley believed that only men trained in railroad management should be in charge of managing the roads. "The railroad employés " he contended, "are much more competent to perform all the duties pertaining to the safe and rapid transportation of freights than any one not conversant with the very many details connected

²⁴Wm. M. Wadley, Assistant Adjutant-General to Presidents and Superintendents of Railroads in the Confederate States, December 15, 1862, Official Records, Ser. 4, v. 2, 273; Wm. M. Wadley to General S. Cooper, Adjutant and Inspector General, December 31, 1862, Official Records, Ser. 4, v. 2, 270-272; Black, Railroads of the Confederacy, 111-112.

therewith, but they can only remain efficient so long as they are held to an entire and strict responsibility."²⁵

Wadley was right. Southern railroads, by the end of 1862, fought to maintain system and control under the duress of constant military demands. Chronic congestion became the norm, and the war took its toll. Conflict between military authorities and railroad managers added to the tension and coordination problems. The situation became so bad that Assistant Adjutant-General W. H. Taylor ordered the end of unwarranted military demands and interference with the railroads. "To avoid the danger . . . of frequent collisions . . . as well as obstruction to all transportation," Taylor wrote, "it is absolutely necessary that the movements of railroad trains should be under one undivided control." This meant that "all trains should be regulated in their movements and speed only by their conductors and engineers, in accordance with the regulations and time-tables of the company." The superintendent of each railroad "controlled" all orders for movement of trains. "Disregard of this rule," Taylor warned, "will inevitably be attended with disastrous consequences."²⁶

The problem did not end, however. Campbell Wallace, president of the East Tennessee & Georgia Railroad, and Jonathan Branner, President of

²⁵Wadley to Cooper, December 21, 1862, Official Records, Ser. 4, v. 2, 271.

²⁶W. H. Taylor, Assistant Adjutant-General, General Orders, No. 1, March 20, 1862, Official Records, Ser. 4, v. 1, 1010-1011.

the East Tennessee & Virginia Railroad, threatened to resign their positions if the government did not stop interfering with railroad operations. "The military," they reported, has "taken possession of the running of our trains, ordering them out in the face of incoming trains, thereby endangering the lives of all on board. . . . Further, the Quartermasters-General set tariffs that "will in a short time break down every railroad company in the South." Wallace and Branner concluded that "the movements of the trains and the control of the finances of the company are ordered by men incompetent, irresponsible and reckless--maybe very good military men, but certainly very bad railroad managers."²⁷ Other railroad managers agreed. L. J. Fleming, superintendent of the Mobile and Ohio, believed that "but for interference in its management, the Government and public would have been better served, the machinery would have been in better condition." George W. Adams, superintendent of the Central of Georgia, complained that "although our effective means of doing the work have been constantly diminishing" the demands from the government had been "increasing."²⁸

²⁷ C. Wallace, President East Tennessee and Georgia Railroad Company and Jno. R. Branner, President East Tennessee and Virginia Railroad Company to J. P. Benjamin, December 4, 1861, Official Records, Ser. 1, v. 52, pt. 2, 227-28.

²⁸ Fifteenth Annual Meeting of the Stokholders [sic] of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1863), 8; Twenty Ninth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1863), 258.

Railroad managers resented government interference and demands.

The superintendent of the Mobile and Ohio asserted that military commanders did not understand the operation of railroads and always made last minute demands that put the railroad out of order and off schedule. Railroad managers also protested the interchange of cars with other roads because they usually never saw them again. George W. Adams the superintendent of the Central of Georgia made this point clear. "For months," he reported, "constant demands have been made on us for Engines and Cars for use on other Roads, with many of which we have been unable to comply without sacrificing our own business." He observed that "many of our Freight Cars are now scattered over the roads of same gauge, from Alabama to Virginia, in use of those roads, without compensation to us, and I fear we shall loose a number of them entirely."²⁹

Other railroad superintendents made similar complaints. Fleming of the Mobile and Ohio angrily told stockholders that "military authorities assumed the supervision of the Road, and trains were forced to run out of time, while the cars were forced upon other Roads, and mutilated and destroyed while thus diverted from the control of the Company's officers." He then outlined why he thought the interchange of cars "will ruin every Road in the Confederate States." He argued that each railroad had cars

²⁹ Fifteenth Annual Meeting of the Stokholders [sic] of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1863), 6; Twenty-Eighth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1862), 231.

"constructed from peculiar patterns" and "when set upon another Road that Road has not the necessary parts to repair them, so that when out of order, they are placed on the side tracks, many of the parts which cannot be replaced are lost, they are rendered useless, and are frequently broken up and destroyed." He figured that his railroad had already lost 141 cars in the first two years of the war.³⁰

At the same time coordination problems plagued southern railroads, they also fell into disrepair. The blockade and a lack of iron created a shortage of materials. Motive power, boilers, tires, and every other imaginable mechanical need went unmet.³¹ The Southwestern of Georgia reported that it had a shortage of iron, timber, and tires. It possessed ten locomotives "but any of the ten are liable to fail at any time." Freight and passenger cars also suffered "owing to the impossibility of procuring material to repair them." The Mobile and Ohio complained it could not procure rolling stock, rail, or spikes because of the blockade. The Charlotte and South Carolina lamented that while income had increased because of government shipments, the "wear and tear" on the line had been "in a corresponding ratio." "The rails," it reported, "in the track have been much worn; the engines are without their usual efficiency; notwithstanding many

³⁰ Fifteenth Annual Meeting of the Stokholders [sic] of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1863), 6.

³¹ Black, Railroads of the Confederacy, 124-125; Ramsdell, "Confederate Government and the Railroads," 798.

cars have been built in the shops during the war, the number on hand is reduced fifty per centum below the average supply." In 1863, the Central of Georgia superintendent asserted it was "in fair condition, notwithstanding the embarrassments under which we have labored. . . . The continuance of the war swells up, every day, the amount which we shall need, at its close, to reinstate the stock of engines, cars and materials."³²

Railroad maintenance also suffered. The Southwestern acknowledged that in 1862 its tracks experienced damage from heavy rains. In peacetime this was a normal occurrence that could be rapidly fixed. In wartime, however, it entailed large expenditures and severe resource reallocation. The superintendent wrote that because of delays in repairs, freight and mail had been diverted to boats. The Central of Georgia imparted that regular maintenance "has not been furnished and kept up as it would have been under ordinary circumstances." The line estimated it needed \$200,000 in repairs. The Charlotte and South Carolina pointed out "that the engines, cars, and track have suffered much, and with our limited resources, require great energy and vigilance to maintain them in proper order." The Mobile and Ohio also noted iron rail, most of it rerolled, was

³²Sixteenth Annual Report. South-Western Railroad Company (Macon, Ga., 1863), 469; Fifteenth Annual Meeting of the Stokholders [sic] of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1863), 3; Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company (Columbia, S. C., 1863), 8; Twenty-Ninth Report. Central Railrcad and Banking Company of Georgia (Savannah, Ga., 1863), 249.

defective and could not take the weight of the engines. As well, spikes and timber became increasingly scarce, and some roads resorted to making spikes by hand.³³

A scarcity of labor added to the railroads' plight. Railroad managers complained that skilled labor had either enlisted to fight or had left for more lucrative employment in ordnance factories. In addition, railroads argued against the draft of skilled mechanics. Although the government exempted most railroad workers, after Gettysburg and Vicksburg, this tension between railroad management and the government rose and exemptions fell. Moreover, railroads had difficulty hiring slave labor. Slaveholders knew that many slaves employed by the railroads escaped or suffered serious injuries and became less anxious to rent them.³⁴ In response, railroads purchased slaves. In 1863, the Charlotte and South Carolina continued its prewar policy and bought 40 slaves, the Mobile and Ohio purchased 60 for \$98,500 and planned to buy a 100 more. The East Tennessee and Georgia bought 32 slaves during the war for \$36,374. The Central of Georgia declared

³³Fifteenth Annual Report. South-Western Railroad Company (Macon, Ga., 1862), 438; Twenty-Eighth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1862), 219, 231-232, 234; Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company (Columbia, S. C., 1864), 7; Fifteenth Annual Meeting of the Stokholders [sic] of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1863), 3; Seventeenth Annual Report. South-Western Railroad Company (Macon, Ga., 1864), 496.

³⁴Black, Railroads of the Confederacy, 83, 129-130.

as early as 1862 that "the advanced prices we are compelled to pay for labor, and all supplies of materials, provisions, clothing, (for our negroes) wood, &c., will largely increase our expenses for the year." The next year, the line doubled the amount of slave labor used.³⁵

Inflation, as well, hurt the railroads' operational abilities. On paper, southern railroads experienced huge profits during the war. But, because of the decreasing power of Confederate money and bonds, these profits proved more of an illusion than a reality.³⁶ Railroad presidents demanded higher freight rates from the government in order to offset the inflationary spiral. Railroad managers complained about the high cost of supplies and labor. The Charlotte and South Carolina report discussed these problems in detail. "All Government freights, with slight exceptions, have been conveyed at rates much below the average charges in times of peace." Ordinarily this freight would have yielded a \$200,000 profit. However, "prices of every element which enters into the operating expenses of railroads have advanced from 50 to 1,000 per cent." Because supplies on hand had run out, the company paid "for many essential articles ten times their former rates."

³⁵ Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company (Columbia, S. C., 1863), 7; Fifteenth Annual Meeting of the Stokholders [sic] of the Mobile and Ohio Rail Road Co. (Mobile, Ala., 1863), 3; Twenty-Eighth Annual Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1862), 235-236; Twenty-Ninth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1863), 249.

³⁶ Black, Railroads of the Confederacy, 134-135.

Other railroads echoed this concern. The Mobile and Ohio demanded higher government freight rates to offset the price of supplies. "The low rate fixed for the transportation of Troops and munitions of war" coupled with the "high price of provisions and supplies used in operating the road" had created a need for higher rates. As the war dragged on, impressment and lack of payment from the government created financial ruin. By the end of the war, southern railroads were owed thousands of dollars from the defeated Confederate government.³⁷

In addition to the lack of materials, poor maintenance, and a labor shortage, southern railroads struggled to maintain system and control. Bureaucratic structures created by railroad managers before the war collapsed under the strain of the conflict and military demands. Logistics, as has been noted, became a nightmare for railroad managers. Moreover, accounting on many lines fell into disarray. Several railroads reported that they had little knowledge of how much they shipped, their costs, or even where many of their freight cars were located. "Our statement of Cars is taken from our shop books," the Central report admitted, but "the number in existence" cannot be "actually ascertained." The superintendent doubted "if three fourths of the actual number we own will be found." In 1862, the Mobile

³⁷ Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company (Columbia, S. C., 1863), 9; Fourteenth Annual Meeting of the Stock-Holders of the Mobile and Ohio Railroad Company (Mobile, Ala., 1862), 3.

and Ohio had to hand write its report and provided no accounting statistics or other data. Many roads simply stopped printing annual reports or keeping statistics.³⁸

Communication and control also became more difficult, but railroad managers still tried to exploit new technology and to attempt better methods of control. The telegraph, for instance, made a significant impact on coordination and control. The Charlotte and South Carolina's superintendent explained the importance of telegraph communication. "The magnetic telegraph," E. Hulbert wrote, "is fast coming into use as a means of communication along the line of railways, and nothing serves so well the purpose of adjusting the movement of trains, of transmitting orders, and of keeping the General Superintendent informed at all hours of the exact condition, in detail, of the whole road, and of all its trains." He explained that "In moving trains by telegraph, nothing is left to chance. Orders are communicated to the conductors and engineers of the opposing trains, and their answers returned, giving their understanding of the order, before either is allowed to proceed." This method differed from controlling trains without a telegraph because "in the absence of a telegraph, conductors are governed by general rules" and it becomes "a question whether a

³⁸Twenty Ninth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1863), 261; Fourteenth Annual Meeting of the Stock-Holders of the Mobile and Ohio Railroad Company (Mobile, Ala., 1862).

reliance on these general rules may not, in many cases, lead to danger by producing recklessness, and thus increase, instead of diminishing, the danger sought to be avoided." He "earnestly" recommended that the railroad install telegraph line at all "our agencies."³⁹

Despite the use of the telegraph, as well as rules and regulations introduced before the war, accidents increased during the conflict. A large number of them occurred because of lack of maintenance. Boilers exploded from overuse, trains derailed, and in some cases collided due to coordination problems.⁴⁰ In 1863, for example, the Central of Georgia had a night passenger train derail, injuring several passengers and killing two railroad employees. In another incident, the Engine Beauregard exploded killing the engineer and fireman. Trains also had to reduce speeds because of the deterioration of the track. Because of the lack of repairs, including iron, joint fastenings, spikes, and cross-ties, the Mobile and Ohio declared that the only way to keep its trains running was with "careful management" and "slow speed." Sabotage also became a problem. The Southwestern of

³⁹Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company (Columbia, S. C., 1863), 13; J. B. Jones reported that the Secretary of War introduced the telegraph in the Secretary's office in late 1862. J. B. Jones, A Rebel War Clerk's Diary at the Confederate State Capital v. 1 (New York: Old Hickory Bookshop, 1935), 162; On the southern telegraph system during the war, see J. Cutler Andrews, "The Southern Telegraph Company, 1861-1865: A Chapter in the History of Wartime Communication," Journal of Southern History 30 (August 1964): 319-344.

⁴⁰Black, Railroads of the Confederacy, 92.

Georgia related one such incident. An engine and three cars derailed because of "the removal of a rail by some malicious person."⁴¹

Of course, the Northern armies had a lot to do with the plight of southern railroads. Defeat on the battlefield took its toll. The Union army understood the importance of railroads and tried to destroy as many southern lines as possible. The incursion into Tennessee in 1862 cut off one of the Confederacy's most important railroads, the Memphis and Charleston, from Memphis to Huntsville, Alabama. Secretary of War Walker had accurately called it "the vertebrae of the Confederacy."⁴² On April 11, 1862, the federal army took Huntsville. It captured all of the Memphis and Charleston Railroad's rolling stock there, eighteen locomotives, one hundred freight cars, six passenger cars, machinery, tools, and cross ties. The railroad tried to move what it could to prevent capture, but "this movement was made in great confusion, and much loss of property necessarily took place." Some equipment made it safely to the

⁴¹Twenty Ninth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1863), 259; Black, Railroads of the Confederacy, 81; Sixteenth Annual Meeting of the Stockholders of the Mobile & Ohio Railroad Company (Mobile, Ala., 1864), 4; Fourteenth Annual Report. South-Western Railroad Company (Macon, Ga., 1861), 408.

⁴²Black, Railroads of the Confederacy, 139-142; Richard E. Beringer, Herman Hattaway, Archer Jones, and William N. Still, Jr., Why the South Lost the Civil War (Athens, Ga.: University of Georgia Press, 1986), 313.

Mobile and Ohio.⁴³ As the Union army made deeper and deeper incursions into the South, they made railroad tracks and equipment a primary target. They tore up track as they advanced, and they captured or destroyed huge amounts of rolling stock. In addition, Confederate authorities destroyed track, locomotives, and freight cars to keep them out of the hands of the Union. General Robert E. Lee, for example, reported in November 1862 that he had "ordered the railroad from Fredericksburg to Aquia Creek to be entirely destroyed; the bridges, culverts, &c., to be broken; the cross-ties piled and fired, with the rails piled on top. . . ."⁴⁴ By 1865, many southern railroads existed on paper only.⁴⁵

To deal with these problems and to try to solve disagreements between the military and the railroad companies, Adjutant and Inspector General Cooper, apparently at Wadley's suggestion, put out another order in early 1863 to correct military officials' mishandling of the railroads. He stressed that military officers must allow the railroad managers "full control of their business, in order to insure safety and dispatch in transportation."

⁴³Twelfth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Co. (Memphis, Tenn., 1866), 2-3.

⁴⁴R. E. Lee to George W. Randolph, November 14, 1862, Official Records, Ser. 1, v. 19, n. 2, 717-718.

⁴⁵For an overview of southern railroads after the war, see The Reports of the Committees of the House of Representatives made during the Second Session Thirty-Ninth Congress, 1866-'67 4 vols. (Washington: Government Printing Office, 1867), 692-703.

"Military officers" were "prohibited from interfering with the engines, cars, running of trains, or with the control and management, in any way, of railroads." He outlined a plan in which quartermaster and commissary officers worked with each railroad's superintendent. The military officer had to notify the superintendents in advance of any freight moving "out of the usual routine." In the event of emergency movements, the military officers should "communicate fully the character and extent of the service . . . and ask the personal supervision of the proper railroad officers to the duty." Cooper urged that military officers use more "discretion" in what constituted an emergency and what could be moved on a regular schedule. Violations of these orders by military officers or the lack of cooperation by railroad managers were to be reported to Colonel Wadley.⁴⁶

A few days after Cooper's orders went out, Quartermaster Myers complained to Secretary of War Seddon that Wadley's new position outside of the Quartermasters Department would cause "much inconvenience and

⁴⁶S. Cooper, Adjutant and Inspector General, General Orders, No. 2, January 3, 1863, Official Records, Ser. 4, v. 2, 295; Lt. General J. C. Pemberton complained to Cooper about this prohibition. "During this time [Jan. 1863] stores in large quantity were being rapidly collected at various depots, but the difficulty of transportation, owing to the wretched condition of the Southern Railroad, the obstacles that were continually thrown in the way of railroad authorities, and the clamor raised at any attempt of mine to make private interests subservient to Government necessities, had the effect of preventing effectually the rapid accumulation of supplies: Positive prohibition had been issued from the War Department against interference of commanding generals or other officers with railroad transportation." J. C. Pemberton to S. Cooper, August 2, 1863, Official Records, Ser. 1, v. 24, pt. 1, 289.

confusion will result." Myers wanted Wadley under his direct control. He believed that the Quartermasters' department had authority and "sole supervision and management of railroad transportation." Wadley, he protested, did not. Therefore, Wadley's proper position in the hierarchy remained in question, as did his authority.⁴⁷

While this debate occurred, both military interference with railroad operations and chronic congestion continued. Wadley understood the railroads' problems, but he also became convinced that centralized control might alleviate some of them. He saw firsthand the chaos brought on by the demands put on railroads by field commanders and other government bureaus.⁴⁸ He wrote Seddon that he had "hoped to induce the officers of all the roads . . . to co-operate with each other . . . but my experience thus far has convinced me that in this I shall be disappointed. . . ." Wadley then made his point clear: "I therefore have recently had my attention directed to some measure that will tend to cure this evil, and have concluded that the best and probably the only remedy capable of reaching the difficulty will be an act of Congress providing for Government to take possession of any railroad that fails to perform promptly Government transportation." He

⁴⁷ A. C. Myers to James A. Seddon, January 8, 1863, Official Records, Ser. 4, v. 2, 304; A. C. Myers to James A. Seddon, January 26, 1863, Official Records, Ser. 4, v. 2, 372-373.

⁴⁸ Black, Railroads of the Confederacy, 115.

acknowledged, however, that the constitutionality of this measure would be questioned.⁴⁹

Continued railroad congestion only heightened Wadley's belief in centralization. In early February, while inspecting the North Carolina railroads, Wadley wrote that "Every day's experience confirms me stronger in the belief that, under existing circumstances, I can do but little toward expediting Government transportation. . . ." A few days later he reported to the Secretary of War that "everything is in the utmost confusion on the North Carolina Railroad. . . ." Others confirmed this view. Major-General G. W. Smith lamented that "railroads are an uncertain reliance; they will worry me out of my life yet I think."⁵⁰

In response, Secretary of War Seddon and Wadley began serious discussions of railroad difficulties. They analyzed the problems facing southern railroads and drew up another plan of action. Again, they met in a convention with railroad presidents and managers to present their ideas. The plan stressed coordination. Railroad presidents and managers, however, contended that coordination was secondary to financial need. By

⁴⁹Wm. M. Wadley to James A. Seddon, January 26, 1863, Official Records, Ser. 4, v. 2, 373.

⁵⁰Wm. M. Wadley to General S. Cooper, February 6, 1863, Official Records, Ser. 1, v. 25, pt. 2, 610-611; W. M. Wadley to James A. Seddon, February 10, 1863, Official Records, Ser. 1, v. 18, 874; G. W. Smith, Major General to James A. Seddon, January 26, 1863, Official Records, Ser. 1, v. 18, 859.

1863, railroads desperately wanted government assistance. They underscored the need for skilled labor, general labor, and supplies. R. R. Cuyler, chairman of the convention, pointedly stated that the Atlanta Rolling Mills, which had produced rail and machines before the war, had been taken over by the government for ordnance production. "That establishment," he complained, "as well as all or nearly all the other iron-works in the country, have been during the war engaged by the Government, and thus the railroads have been deprived of every means of supply." As for skilled labor, "many mechanics absolutely necessary toward keeping up railroad works are now in the Army." Railroad managers also wanted less interference in their operations from government and military officials. They asserted that if they were left alone the system would work better and more efficiently. The conference broke down in recrimination as each side blamed the other for their difficulties. The railroads rejected government control while the government refused much aid without it.⁵¹

It had become clear that voluntary cooperation between railroads and the government had failed. After the April 1863 convention, Seddon wrote several members of the Confederate Congress that railroads required governmental control because of "the selfish instincts inherent in money-making corporations." He proposed that control of the railroads should be

⁵¹R. R. Cuyler, Chairman to J. A. Seddon, April 22, 1863, Official Records, Ser. 4, v. 2, 509-510; Black, Railroads of the Confederacy, 119-120; Goff, Confederate Supply, 109.

put under an executive officer who would have the authority to enforce decrees by seizing the property of any railroad that did not follow orders. In this proposal, he echoed Wadley's position.⁵²

At the end of April, the Confederate Congress passed and Jefferson Davis signed the first important railroad law. It provided the necessary power to regulate the railroads. It gave the government power to make any railroad support the army and obliged railroads to follow government schedules. The government could impress any railroad equipment, such as locomotives, cars, rails, and machinery. In theory, this law gave the government the authority it needed to control and coordinate southern railroads. The law gave the Quartermaster General the power to regulate the railroads, set through rates, and interchange cars as necessary. If a railroad refused to cooperate, it could be seized and the workers conscripted. This law did not solve centralization problems, however. Rather than giving this government power to Wadley and the Railroad Bureau, supervision of the railroads stayed under the control of the Quartermasters' Department. Moreover, the man behind the railroad centralization law, Wadley, lost his job. Although it remains unclear why, the Senate refused to confirm him. Business jealousies and politics appear to have been at the

⁵²Quote from Black, Railroads of the Confederacy, 121; Goff, Confederate Supply, 110.

root of this action. Thus, a railroad law had finally been passed, but its operation remained uncertain.⁵³

Frederick W. Sims took charge of the Railroad Bureau. He had worked under Wadley as a transporting agent for the Central of Georgia and understood railroad management. Unfortunately, he inherited a bureau without administrative control of transportation. Sims had to try to assert power through the Quartermasters' Department. More important than this bureaucratic chaos, however, became the action of the Confederate government. The executive branch refused to enforce the new law for fear of alienating the railroads and state governments.⁵⁴

Despite the obstacles he faced, Sims tried to build the Railroad Bureau into an organization with power. He placed subordinates at key railroad crossroads to facilitate movement. He gained significant control when Alexander Lawton, a West Point graduate, became the new Quartermaster General in August 1863. Lawton and Sims had been long-time friends and worked well together. Sims now fit into the Quartermasters' chain of

⁵³Black, Railroads of the Confederacy, 121-123; Goff, Confederate Supply, 110-111; Ramsdell, "Confederate Government and the Railroads," 800; This jaundiced view of railroads became prevalent by 1863. J. B. Jones asserted that "the Southern Express Co. has monopolized the railroads, delivering cotton for speculators, who send it to the United States, while the Confederate States cannot place enough money in Europe to pay for the supplies needed for the army." Jones, Rebel War Clerk's Diary, v. 2, 82.

⁵⁴Black, Railroads of the Confederacy, 164-167; Goff, Confederate Supply, 195.

command and his orders carried more authority. He also traveled widely in an attempt to solve problems and clear up congestion.⁵⁵

Sims, unlike many military officers and civilian critics, remained sympathetic to the plight of the railroads. He told Lawton that railroad companies had served the Confederacy "with patriotism which I fear has never been properly appreciated. . . . The managers of them embraced the best business talent and exhibit as much patriotism as any class in the country." He thought the government had squandered this talent by demanding too much and giving too little. Freight rates paid by the government remained much too low. More important, the lack of a consistent government policy had led to chaos in running lines. "To complete what Government officers first thought to be the best plan for transportation," he asserted, "but which every railroad man knew to be a most destructive one," the military "ordered engines and cars from road to road, irrespective of ownership, and making no provisions for their return." Moreover, he attested that "this valuable property was used and abused from one end of the Confederacy to the other, cars were run from point to point without attention and only found rest in total destruction. . . ."⁵⁶

⁵⁵ Black, Railroads of the Confederacy, 168-171.

⁵⁶ F. W. Sims, Major and Quartermaster, to Brig. Gen. A. R. Lawton, Quartermaster-General, October 23, 1863, Official Records, Ser. 4, v. 2, 881-883.

Sims believed that the problem with interchange of cars now had a "wiser policy" because of orders that kept rolling stock under the control of railroad superintendents. Nevertheless, the deterioration and destruction of the lines posed a significant barrier to improving transportation. Sims explained that the lack of supplies and the lack of repair of locomotives and cars had left most railroads in poor shape. By 1863, even "the richest and most provident companies are feeling severely the want of the most ordinary articles." He asked rhetorically, "Is it any wonder that transportation is deficient? Is it not rather a wonder that we have any transportation by rail at all?" He blamed this situation on the government, not the railroad companies. "Every important article of consumption by railroads," he asserted, "can be produced in the Confederate States, but so long as the Government controls and denies the roads, you may say, practically everything, there will be no permanent relief for them." He argued that rolling mills, foundries, and machinery should be applied to supplying the railroads. He noted that the only way there was enough equipment at the present time was from "contraction of our territory" and "the time will soon come when the Government itself will be incompetent to render even this assistance."⁵⁷

In order to address these problems, Sims called yet another railroad convention in November 1863. As Wadley had before him, he tried to set

⁵⁷ Ibid.

up a coordinated car interchange system. The railroad presidents balked. They continued to resist car interchange and asked for a freight rate increase. Because the Davis administration refused to implement the new railroad law, Sims had little power. Sims did, however, make progress on concentrating rolling stock on important lines. Locomotives and cars from railroads that had been moved from captured territory were put under government authority and shifted to roads that had the most use and congestion. In this way, Sims unplugged important clogs on some railroads. This stop-gap measure, however, did not create a coordinated railroad system.⁵⁸

Nonetheless, Sims also understood the complaints of railroad managers that many military men did not have a clue how to run a railroad. If railroads required centralization, system, and control, they needed to be under a separate Railroad Bureau operated by railroad managers. A railroad, he wrote, "can only be managed by one who has been educated to it, and it is to this extent a specialty differing from any element heretofore entering into military operations. The importance of properly managing transportation, thus rapidly concentrating troops or supplies, can only be manifest to those whose daily business enables them to see the difficulties arising from a want

⁵⁸Black, Railroads of the Confederacy, 172-173; Ramsdell, "Confederate Government and the Railroads, 807.

of control of the movement of trains."⁵⁹ In other words, railroads needed the government's visible hand of management staffed by railroad managers who understood bureaucratic control and coordination.

With the goal of centralized control under men who understood railroad operations, Sims drew up legislation for a powerful, independent Railroad Bureau. Bently Hasell, who was also president of the Charleston & Savannah Railroad, got his nephew Lewis Cruger to submit it to the House. It did not even make the legislature's calendar.⁶⁰ Thus, the problems that plagued southern railroads in 1861 continued. Sims complained that the military hurt the railroads in two critical ways. First, by impressing railroads and demanding immediate service, they ruined what efficiency remained. "It is not at all unusual," he wrote, "for persons to suppose that they can manage railroads with much more ability than those who have them in charge." Second, Sims also disagreed with further draft calls that included mechanics and machinists. "I am willing to do all that I can do," he complained, "but to improve transportation without men and materials is the requisition of the Egyptian taskmaster. Give me the men and you shall see advantages from them. Refuse and I can promise nothing."⁶¹

⁵⁹ Quoted in Black, Railroads of the Confederacy, 174.

⁶⁰ *Ibid.*, 175.

⁶¹ F. W. Sims to A. R. Lawton, February 22, 1864, Official Records, Ser. 4, v. 3, 92-93.

At the same time, Sims became increasingly frustrated with railroad presidents and managers. He complained to Lawton that they would not cooperate. When he tried to consolidate three lines under one company in North Carolina, he noted heatedly that "three presidents and as many superintendents will be sure to find reasons why no good could result from such an arrangement."⁶² Early the next month, Sims replied to questions from William Burwell of the Virginia legislature about problems with the railroads. Sims explained that car interchange remained a conundrum. "It is almost an impossibility for those who have had not practical experience to understand how any difficulty can arise from interchanging cars," he wrote, "and yet it is most fruitful of destruction to property." Once out of the control of the railroad company, "cars never get the proper attention . . . and with the present scarcity it is the true policy to husband them with care." Sims now concluded the remedy for controlling railroads was direct government supervision. "That railroads should come under military control," he averred, "I am becoming every day more satisfied. There seems to be a desire to work for the road's interest rather than sacrifice all convenience for the country's cause." He thought military control had become the only way to build a coordinated system and "greater harmony." Railroad managers, he believed, should "retain their positions, but should

⁶²F. W. Sims to A. R. Lawton, March 31, 1864, Official Records, Ser. 4, v. 3, 258.

be directly amenable to Government, and made to feel that the interests of Government were paramount to every other consideration."⁶³ Thus, Sims wanted railroad managers who understood railroad management under the control of military officers. He thought this setup was the only way the rail system could work.

That centralized control of the railroads might succeed was shown in March 1864. In order to feed Lee's troops in Virginia, the War Department followed Sims' suggestion and put the Augusta-Charlotte-Weldon railroad line under military control. It canceled all passenger trains, and freight movement received top priority. Under government control, the railroad delivered 3,000 bushels of corn and sufficient meat to feed Confederate troops. When the railroad presidents protested, Quartermaster General Lawton replied, "The results have fully vindicated the act of the War Dept. More Govt. stores have been transported from Wilmington & Charlotte to Richmond in the last five days, than ever before, during this war, in the same space of time."⁶⁴ This success convinced many in the Confederate government that centralized control could work. Jefferson Davis, however, disagreed. He wrote Seddon in April 1864 that "I am not encouraged by the

⁶³F. W. Sims to A. R. Lawton, April 1, 1864, Official Records, Ser. 4, v. 3, 228; The next month, J. B. Jones reported that "a list is being prepared at the War Department (by Mr. Assistant Secretary Campbell) for Congress to pass, authorizing the seizure of all the railroads in the Confederacy." Jones, Rebel War Clerk's Diary, v. 2, 213.

⁶⁴Quoted in Goff, Confederate Supply, 199.

past to expect that all difficulties would be removed by transferring the management of these extensive organizations to the agents of the War Department." The government gave control back to the railroads and shipments declined. It is not clear whether Seddon or Davis canceled military control, although Northrop argued that Seddon backed down due to political pressure.⁶⁵

Despite the lack of centralized government control, southern railroads continued to operate. Sims defended his department and the railroads despite his own frustrations. When it was suggested that the railroads had not made any progress in supplying the Army of Northern Virginia, he vehemently protested. "Great efforts have been made, and with success," he argued. Between Augusta and Richmond, "probably 15 locomotives and 200 freight cars are now working between those two points which were not there last year." As for complaints about corn not being delivered from Gaston, he pointed out that it happened because General Pickett seized the railroad and caused a complete "stoppage of business on

⁶⁵Ibid., 199-201; J. Davis to Secretary of War, April 23, 1864, Official Records, Ser. 1, v. 51, pt. 2, 852; J. B. Jones wrote that "the deplorable conditions of the railroads, or rather of the management of them. Col. Northrop, Commissary-General, said to-day that Gen. Lee and the Secretary of War were responsible for the precarious state of affairs, in not taking all the means of transportation for use of the army; and that our fate was suspended by a hair." J. B. Jones, A Rebel War Clerk's Diary v. 2, 188.

this road." He asked if "such delays [were] chargeable to transportation or the system under which it is conducted?"⁶⁶

Tighter conscription laws also hindered the railroads' abilities to operate. Sims complained when the war caused removal of workers from the North Carolina Railroad. He argued that with railroads in such poor condition, maintenance of machinery and track made skilled labor even more essential. "The worst feature in reducing the force upon a railroad," he explained, "is that the deterioration consequent upon such a step. . . ." He labored to explain that the North Carolina had run efficiently because the government gave it needed men and materials. "We have fostered it and encouraged it until its condition is vastly improved," he commented, but this new law would destroy these gains. He closed by calling it "a short-sighted policy that runs the road's machinery down. . . . No lesson seems to have been learned by experience."⁶⁷

By this point, military losses made conditions even worse. In order to keep railroads running, track was ripped up and rolling stock moved to areas not threatened by military conquest. In 1864, the Mobile and Ohio reported that Sherman and his troops had "energetically engaged" in tearing up the road's track in Mississippi. The Central of Georgia told stockholders

⁶⁶F. W. Sims to A. R. Lawton, February 22, 1864, Official Records, Ser. 4, v. 3, 92-93.

⁶⁷F. W. Sims to General Lawton, August 16, 1864, Official Records, Ser. 4, v. 3, 598-599.

in 1865 that Sherman's army had destroyed 139 miles of track and that the road did not have the materials to repair them. Virgil Powers, of the Southwestern Georgia, reported that "Our motive power has depreciated materially in the past four years," but it had done well "considering the difficulties of procuring material and labor for necessary repairs."⁶⁸

Finally, on March 9, 1865, the House Military Affairs Committee put forth another resolution to take control of the railroads: "An Act to provide for the more efficient transportation of troops, supplies and munitions of war upon the railroads, steamboats and canals in the Confederate States, and to control telegraph lines employed by the Government." With the passage of the act, the Secretary of War took charge "of any railroad . . . considered as forming part of the land forces of the Confederacy. . . ." He also had authority to set through trains.⁶⁹ Nonetheless, railroad presidents and superintendents still believed that government interference caused more problems than it solved. "I am fully persuaded that with different management," Lem. Peebles, President of the South Side Railroad wrote,

⁶⁸Sixteenth Annual Meeting of the Stockholders of the Mobile & Ohio Railroad Company (Mobile, Ala., 1864), 5; Thirtieth Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1865), 278; Eighteenth Annual Report. South-Western Railroad Co. (Macon, Ga., 1865), 513.

⁶⁹"A bill to provide for the more efficient transportation of troops, supplies, and munitions of war upon the railroads, steamboats, and canals in the Confederate States," Journal of the Congress, v.7, 584-585; Charles Ramsdell, Laws and Joint Resolutions of the Last Session of the Confederate Congress (November 7, 1864-March 18, 1865) Together with the Secret Acts of Previous Congresses (Durham, N. C.: Duke University Press, 1941), 60-61.

that "more can be done than is proposed by this change. Indeed, I think that the Government will gain nothing, and it may result in positive injury to this company."⁷⁰

The government and railroad managers did not heed the lessons learned by the individual railroad corporations before war—the importance of bureaucratic control. The Confederacy never properly organized its railroad system. Indeed, it lacked men, supplies, motive powers and cars. Yet, many of the problems may have been alleviated to some extent with proper organization and control. A centralized system may have advanced the South's military efforts. The irony remains that the South's first big business, which had incorporated many new bureaucratic ideas during the 1840s and 1850s, suffered from a control crisis during the war. Near the end of the hostilities, Sims lamented the fact "that the hand of Government" had remained an "undefined idea" throughout the war with regard to the railroads. The only authority over the roads, he commented, had "resulted in a law so full of loopholes that it is inoperative."⁷¹ Thus, although some understood the need for system and organization of railroads, they could not implement them. Nevertheless, lessons learned during the war would be adopted in creating a New South. Other areas of the Confederate war effort,

⁷⁰Lem. Peebles, President South Side Railroad to J. C. Breckinridge, March 23, 1865, Official Records, Ser. 1, v. 46, pt. 3, 1335.

⁷¹F. W. Sims to Brigadier-General Lawton, February 10, 1865, Official Records, Ser. 4, v. 3, 1092.

however, especially the Ordnance Department, incorporated new ideas of system, uniformity, and bureaucratic control effectively.

CHAPTER 4

SYSTEM AND WAR: THE CONFEDERATE ORDNANCE DEPARTMENT AND UNIFORM PRODUCTION OF AMMUNITION*

The poor coordination and control of the Confederate railroads demonstrated the importance of bureaucratic organization. Although they had developed management hierarchies, railroads had failed under the pressure of war. By war's end the Confederate government could barely feed and clothe its troops. Ammunition and gunpowder, however, continued to be produced in adequate amounts. Brigadier General Josiah Gorgas, chief of the Ordnance Department, Lieutenant Colonel John W. Mallet, commander of the Confederate laboratory at Macon, Georgia, and George Washington Rains, commander of the Confederate Powder Works at Augusta, Georgia, enhanced the Confederacy's ability to wage a long and destructive war.¹

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¹The most important work on the Confederate Ordnance Department remains Frank E. Vandiver Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance (Austin: University of Texas Press, 1952). The most significant article on this topic is W. Stanley Hoole, "John W. Mallet and the

The Confederate Ordnance Department created a minor industrial revolution in the South that incorporated the latest ideas of the American System of Manufacturing. These ideas helped transform the South. With the application of modern management techniques, control processes, and bureaucratic structures, they brought a system of order and uniformity to the fabrication of ammunition and gunpowder. Indeed, by the end of the war, Gorgas, Mallet, and Rains had successfully incorporated into the Ordnance Department the principles and methods of what would later be recognized as the bureaucratic system of corporate management. These men and the management methods they used would later help to create a New South.

The need for standardized weapons and ammunition posed a daunting challenge for Gorgas and Mallet. Although they never completely overcame the Department's internal problems, they did take significant steps toward systematizing its manufacture of ammunition by incorporating the bureaucratic changes that evolved in ordnance production and management

Confederate Ordnance Laboratories, 1862-1865," The Alabama Review 26 (January 1973): 33-72, which focuses on Mallet's visits to the many arsenals and the construction of the laboratory. Another valuable source is Maurice Kaye Melton, "Major Military Industries of the Confederate Government" (Ph.D. diss., Emory University, 1978). For a good overview of the Confederate supply system see Richard Goff, Confederate Supply (Durham, N.C.: Duke University Press, 1969). For a more sympathetic view of the Confederate Commissary Department see Jerrold Northrop Moore, Confederate Commissary General: Lucius Bellinger Northrop and the Subsistence Bureau of the Southern Army (Shippensburg, Pa.: White Mane, 1996).

after the War of 1812.² During the War of 1812, the military's lack of preparation and poor performance taught American officers and astute politicians, such as John C. Calhoun of South Carolina, that a centralized system for the production of firearms was required. In 1815, consequently, Congress placed the national armories at Springfield, Massachusetts, and Harpers Ferry, Virginia, under the supervision of the Ordnance Department. At that time, the Ordnance Department looked to the French military's system of arms production, as outlined in Major Louis de Tousard's three-volume text entitled American Artillerist's Companion. Tousard was one of many French officers who emphasized that arms making needed "'a system of uniformity and regularity' based on scientific theory and experimentation." The French system had depended on the introduction of standardized parts, improved production techniques, and inspection of arms

²See especially Merritt Roe Smith, Harpers Ferry Armory and the New Technology: The Challenge of Change (Ithaca: Cornell University Press, 1977); Otto Mayr and Richard C. Post, eds., Yankee Enterprise: The Rise of the American System of Manufacturers (Washington, D.C.: Smithsonian Institution Press, 1981); Merritt Roe Smith, ed., Military Enterprise and Technological Change: Perspectives on the American Experience (Cambridge, Mass.: The MIT Press, 1985); James J. Farley, Making Arms in the Machine Age: Philadelphia's Frankford Arsenal, 1816-1870 (University Park, Penn.: The Pennsylvania State University Press, 1994); David A. Hounshell, From the American System to Mass Production, 1800-1932: The Development of Manufacturing Technology in the United States (Baltimore: The Johns Hopkins University Press, 1984); Alfred D. Chandler, Jr., The Visible Hand: The Managerial Revolution in American Business (Cambridge, Mass.: Belknap Press, 1977); James R. Beniger, The Control Revolution: Technological and Economic Origins of the Information Society (Cambridge, Mass.: Harvard University Press, 1986).

and ammunition. In 1817, Major Sylvanus Thayer introduced the French ideas of scientific accuracy and methods to the curriculum of the United States Military Academy. West Point cadets began to study chemistry, mathematics, physics, engineering, and military drawing. Thereafter, the military academy produced a new breed of "soldier-technologists" who understood the nexus between technology and warfare.³

The Ordnance Department's emphasis on uniformity in the production of munitions also encouraged the growth of bureaucratic structures to ensure quality control. Moreover, these structures began to permit the control of production, accounting, and distribution of arms as

³ Merritt Roe Smith, "Army Ordnance and the 'American System' of Manufacturing, 1815-1861," in Military Enterprise and Technological Change, 42-46; Farley, Making Arms in the Machine Age, 36; See also Stanley L. Falk, "Soldier-Technologist: Major Alfred Mordecai and the Beginnings of Science in the United States Army" (Ph.D. diss., Georgetown University, 1959); For an excellent analysis of the French adoption and abandonment of interchangeable parts, see Ken Alder, Engineering the Revolution: Arms and Enlightenment in France, 1763-1815 (Princeton: Princeton University Press, 1997) and his article, "Innovation and Amnesia: Engineering Rationality and the Fate of Interchangeable Parts Manufacturing in France," Technology and Culture 38 (April 1997): 273-311; Alder makes a convincing argument that technological change, in this case the uniformity system in arms making, does not take a predetermined path. Myriad factors, including social, cultural, economic, and political constraints, can lead to the modification or abandonment of a new technology. Technological change, therefore, does not occur in a vacuum and the possibility of alternative paths, Alder argues, should be examined. The idea that technological change does not follow a predetermined path is also examined in Merritt Roe Smith's study of antebellum arms making at Harpers Ferry. Smith found considerable resistance to technological change from supervisors and workers at Harpers Ferry Armory. Smith, Harpers Ferry Armory, 104-252.

well as coordination between the separate arms factories. For Ordnance officers, uniformity and control became key concepts. Slowly, and with considerable opposition from some civilian supervisors, the Ordnance Bureau implemented its program. By the 1820s, the Ordnance Department introduced monthly, quarterly, and annual reports, all done with double-entry bookkeeping for materials, production, payroll, equipment, buildings, and inventory. Accurate inventory control allowed coordination of arms shipments, especially helpful in times of emergency or war. By the 1830s, the officers of the Ordnance Bureau operated like a modern bureaucracy with clear lines of authority and communication which provided managerial control over their large geographic network.⁴

The complicated introduction of uniformity of weapons developed as decision makers incorporated machine tools technology and managerial techniques that allowed for more rigorous standards. For example, frequent inspections and the use of more sophisticated steel gauges to measure the accuracy of component parts greatly enhanced the standardization of arms and ammunition. By the late 1820s, this system enabled the Ordnance Bureau to implement the "Springfield standard" which used master gauges to inspect and report on the uniformity at each of the arsenals. The

⁴Smith, "Army Ordnance and the 'American System,'" 56-58, 69; Charles F. O'Connell, Jr., "The Corps of Engineers and the Rise of Modern Management, 1827-1856," in Military Enterprise and Technological Change, 88-116; Alfred D. Chandler, Jr., "The American System and Modern Management," in Yankee Enterprise, 153-170.

continued stress on uniformity, standardization, and the improvement of machine tools produced the first fully interchangeable firearms manufactured in large numbers, the Model 1841 percussion rifle and 1842 percussion musket. In the four decades before the Civil War, the U. S. Ordnance Department, through much trial and error, struggled to introduce system, uniformity, and control.⁵

During the war, the South had to turn to West Point graduates and other technical specialists to arm and equip its army. The regularity, uniformity, and order that dominated military thinking by the mid-nineteenth century now had to be applied on a larger scale than Southerners could have ever imagined. The bureaucratic system of control developed by the U. S. Ordnance Bureau and railroad management provided a framework that Josiah Gorgas and John W. Mallet tried to adopt for the Confederacy. With their scientific and technical backgrounds, they understood the "control revolution" occurring in manufacturing, communication, and

⁵Smith, "Army Ordnance and the 'American System,'" 59-64, 74, 83; Hounshell, From the American System, 21-25; Paul Uselding, "Measuring Techniques and Manufacturing Practice," in Yankee Enterprise, 103-123; For a detailed discussion see Smith, Harpers Ferry Armory, 184-251, 280-292; Nathan Rosenberg, "Technological Change in the Machine Tool Industry, 1840-1910," The Journal of Economic History 23 (December 1963): 414-420; Merritt Roe Smith, "John H. Hall, Simeon North, and the Milling Machine: The Nature of Innovation among Ante-bellum Arms Makers," Technology and Culture 14 (October 1973): 573-591.

transportation.⁶ Indeed, Gorgas and Mallet both personified the idea of “soldier-technologists.”

Born in Running Pumps, Pennsylvania, in 1818, Josiah Gorgas graduated from West Point in 1841, upon which he entered ordnance duty as a brevet second lieutenant. In 1845, he visited several European arsenals as well as military schools and factories in France. During the Mexican War, he experienced firsthand the chaos created by poor planning and logistics at the Vera Cruz ordnance depot. After the war, he served at many major arsenals. Gorgas’ educational, technical, and organizational experience placed him in the forefront of his profession when the sectional crisis erupted.⁷ As such, he was among the relatively small number of early

⁶O’Connell, “The Corps of Engineers,” 103-105; Beniger, The Control Revolution, 202-218.

⁷Vandiver, Ploughshares into Swords, 11-14; See also Frank E. Vandiver, “A Note on Josiah Gorgas in the Mexican War,” The Journal of Southern History 11 (February 1945); Gorgas to Commander of the Baton Rouge Arsenal, 1847, United States Army Collection, Ordnance Department, Louisiana and Lower Mississippi Valley Collections, LSU Libraries, Louisiana State University, Baton Rouge; Farley, Making Arms in the Machine Age, 70-71; See also Keir B. Stirling, Serving the Line with Excellence: The Development of the U. S. Army Ordnance Corps (Washington, D.C.: U.S. Government Printing Office, 1987), 25-26; Sarah Woolfolk Wiggins, ed., The Journals of Josiah Gorgas, 1857-1878, with a forward by Frank E. Vandiver (Tuscaloosa: The University of Alabama Press, 1995), 4-37; Vandiver, Ploughshares into Swords, 51-53; For an overview on Jefferson Davis’ selection of Gorgas see Stanley L. Falk, “Notes and Documents: Jefferson Davis and Josiah Gorgas, an Appointment of Necessity,” The Journal of Southern History 28 (February 1962): 84-86.

organizers of what, after the Civil War, would become recognizable as the modern bureaucratic system of production.

John W. Mallet arrived at his position as Gorgas' assistant at the Confederate Ordnance Bureau by a very different route. Not a soldier by training, he was a man of science and technology. Mallet was born October 10, 1832, in Dublin, Ireland. His father, Robert, a trained engineer, a Fellow of the Royal Society, and an owner of a metal foundry, studied the construction of guns and the composition of explosives and powders. John Mallet followed his father's footsteps and studied the classics, physics, and chemistry. He took private instruction from a lecturer at the Royal College of Surgeons of Ireland, Dr. James Apjohn, who taught him how to analyze minerals chemically and directed him toward the serious study of organic chemistry. At the same time, Mallet and his father studied different gunpowders and evaluated their shock value. At the University of Dublin Mallet distinguished himself as a gold medalist in Experimental Physics. A year later, he made a name for himself with the publication of his first article in the Journal of the Geological Society of Dublin.⁸

⁸John W. Mallet, "Memoranda of My Life for My Children," TMs [photocopy] p. 1-3, 26, Special Collections/Manuscripts, Alderman Library, The University of Virginia, Charlottesville; Desmond Reilly, "John William Mallet (1832-1912): His Earlier Work in Ireland," Journal of Chemical Education 25 (November 1948): 634; Melton, "Major Military Industries," 299; Hoole, "John William Mallet," 36; Apjohn is best known for his study on determination of dew point. Reilly, "John William Mallet," 634; Robert Mallet, Third Report on the Facts of Earthquake Phaenomena: Catalogue of

In 1852, Mallet earned his doctorate at University of Göttingen where he received additional training from the well-known chemist Friedrich Wöhler. In July 1853, Mallet and his father traveled to the United States to examine the Ericson caloric engine, and although Mallet had planned to return to Europe, he decided to remain in America. In 1854, he began teaching analytical chemistry at Amherst College. In January 1855, he accepted the position of chemist for the State of Alabama's Geological Survey team located in Tuscaloosa. The University of Alabama offered Mallet a position as a chemistry professor, which he accepted in addition to his duties with the Geological Survey. By this time he had published more than sixteen scholarly articles, many in The American Journal of Science and Arts.⁹ Mallet's employment was part of the educational reform taking

Recorded Earthquakes From 1606 B.C. to A.D. 1850 (London: Taylor and Francis, 1852).

⁹Mallet, "Memoranda of My Life," 3-4, 20, 26-27; When Mallet arrived at Göttingen, Wöhler had begun to focus his research on "inorganic and mineralogical chemistry." Frank N. Magill, ed. The Great Scientists (Danbury, Conn.: Grolier Educational Corporation, 1989), v. 12, 146-151 "Friedrich Wöhler," by John A. Heitman; Reilly, "John William Mallet," 635-636; F. P. Dunnington, "A Sketch of Dr. John William Mallet, as a Chemist and a Teacher," Journal of Chemical Education 5 (January 1928): 184; The American Journal of Science and Arts began publication in 1818, and became one of the most important scientific journals in the country with articles from the foremost American scientists. Among Mallet's articles were: "Analysis of Tin Pyrites" 17 (May 1854): 33-35; "On Phosphate of Iron and Manganese from Norwich, Mass." 18 (November 1854): 33-34; "Analysis of Idocrase from Ducktown, Polk Co., Tenn." 20 (November 1855): 85; "On a Zeolitic mineral (allied to Stilbite) from the Isle of Skye, Scotland" 22 (November 1856): 179; "Re-determination of the Atomic Weight of Lithium" 22 (November 1856): 349-356; "Results of some Analysis made for

place in the antebellum South. Southern institutions, such as the University of Alabama, were hiring experts to teach science and technology to a new generation. It was no coincidence that Mallet lived and taught in Alabama in the late 1850s.

In 1860, Mallet began teaching chemistry as a member of the medical faculty at the newly established Medical College of Alabama in Mobile. He still held a position as a lecturer at the University of Alabama and, in the secession spring of 1861, returned to Tuscaloosa to teach a class. He then proceeded to Virginia to visit Colonel Robert E. Rodes who commanded the 5th Alabama regiment located at Bull Run. The two were friends, having met when Rodes worked in Tuscaloosa as a professional railroad engineer. On this visit, Mallet saw firsthand the carnage and destruction left after the first Battle of Bull Run. Upon his return to Tuscaloosa, Mallet enlisted as a private in a the local cavalry unit and went through several weeks of drill with the brigade. When Colonel Rodes received a promotion to brigadier general, he sent for Mallet to become his aide-de-camp. Mallet accepted the position and received a commission as a first lieutenant on November 16, 1861, on the field of Bull Run.¹⁰

the Geological Survey of the State of Alabama" 23 (May 1857): 181; "On the Separation of Magnesia and Lithia" 24 (November 1857): 137-139; "On Schrötterite from Cherokee Co., Alabama" 26 (November 1858): 79-81; and "On the Atomic Weight of Lithium" 28 (November 1859): 349-354.

¹⁰ Mallet, "Memoranda of My Life," 5-6.

In the spring of 1862, when Colonel Briscow Baldwin, the Chief of Ordnance for the Army of Virginia, visited his old friend General Rodes, he met Rodes' aide-de-camp, Lieutenant Mallet. Impressed with the young scientist's knowledge of ordnance, Baldwin invited Mallet to visit the office of Colonel Gorgas. Gorgas, badly in need of an officer with the scientific skill to deal with the abundance of ammunition problems, wanted to interview Mallet. "The result of several interviews," Mallet remembered, was "to at once endeavor to bring order out of the confusion. . . ."¹¹

Mallet's description of affairs was apt. In order to meet the immediate demands of an army put together largely in an ad hoc fashion, the Confederate Ordnance Department initially purchased weapons from private dealers or paid volunteers who brought their own. As a result, the Confederate army had a variety of arms ranging from 1812 flintlocks to the modern Enfield rifle. The Confederate Ordnance Department faced the daunting task of trying to bring about a system to overcome this lack of standardization. "In the scramble of the early part of the war to obtain at once arms of some kind, both at home and abroad, a most heterogeneous collection was gathered," Mallet wrote, and "as a natural consequence there was serious trouble at the arsenals and in the field, from confusion in regard to ammunition--trouble which was made worse by the gauges in use in the

¹¹Ibid.; John W. Mallet, "Work of the Ordnance Bureau of the War Department of the Confederate States, 1861-1865," Southern Historical Society Papers 37 (1909): 8; Vandiver, Ploughshares into Swords, 113.

ordnance shops, which were not very accurate and often did not agree among themselves."¹²

Throughout 1861 and 1862, the call for arms and ammunition from the field became incessant. "Our troops, [are] raw, unequipped, not half armed and accoutered, [and] untented," Brigadier General Henry A. Wise complained in July 1861. Brigadier General M. L. Bonham concurred and wrote General Lee that the troops had "little ammunition, but exhibit admirable spirits." As arms trickled in from the efforts of blockade running, ammunition standardization became a primary concern, especially because the widely scattered southern arsenals had few mechanisms to ensure quality control. Bullets for the same caliber gun often varied in size and weight depending on which arsenal made them. An ordnance officer in Tennessee complained of the "great difficulty . . . in obtaining cartridges to suit the calibre of the guns in this division." He further observed that the ammunition sent "frequently" contained the wrong type and the Enfield ammunition was almost always too large, "causing men whose guns become choked to throw them away as useless." Such complaints appeared frequently in officers' reports. One officer observed that the soldiers had difficulty lodging "the bullet home" after firing "15 or 20 rounds."¹³

¹²Frank E. Vandiver, "Makeshifts of Confederate Ordnance," The Journal of Southern History 17 (May 1951): 181; Melton, "Major Military Industries," 296-297; Mallet, "Work of the Ordnance Bureau," 3, 7-8.

¹³Report of Brigadier General Henry A. Wise, July 17, 1861, Ser. I, vol.

In addition to the problems with bullets, no system of packaging and identifying of ammunition existed. Furthermore, time fuses rarely detonated with accuracy. General P. G. T. Beauregard complained of faulty fuses that caused inaccuracy, misfires, and failed timed explosions. Brigadier General John B. Magruder lamented the "defect[s] about our shells" with one-half exploding "at the muzzle of the piece," a condition he blamed on the composition of the shells, and he dismissed the friction tubes as "worthless." "We shall be ruined," he concluded, "unless you [Gorgas] can send me good shell and spherical-case shot and good friction primers."¹⁴

In April 1862, the production of ammunition appeared so poor that General Daniel H. Hill, commander at Yorktown, charged that there must be "treachery" in the Ordnance Department. Gorgas responded that the problems associated with ammunition production were not sinister in nature, but bureaucratic. "If an experienced ordnance officer could have supervised the laboratory here [Richmond]," Gorgas wrote, then, "bad ammunition and worse guns could not now be complained of." He did admit, however, that there was "ample reason for criticism in the products

II, 290; M. L. Bonham to R. E. Lee, May 25, 1861, Ser. I, vol. II, 43; Riley to Headquarters Army of Tennessee, October 1, 1863, Ser. 1, v. 30, pt. 2, 314; Oladowski to Johnson, March 1863, Ser. 1, v. 23, pt. 2, 763, War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies (127 volumes; Washington, D. C.: 1880-1901). Hereafter cited as Official Records.

¹⁴Melton, "Major Military Industries," 297; Beauregard to Cooper, September 16, 1863, Official Records, Ser. 1, v. 27, pt. 2, 365; Magruder to

of our laboratories and foundries. . . ."¹⁵ Clearly, the Confederate Ordnance Department faced a control crisis in the production of ammunition.

Gorgas believed that centralization of production could provide the solution to his control problems. He planned a centralized laboratory with a general superintendent to oversee and inspect the production of ammunition.¹⁶ In addition, Gorgas expected to employ modern military principles with the bureaucratic control structures that included rigorous guidelines, schedules, procedures, records management, and quality control.¹⁷ In other words, he wanted to create a system of organization modeled after the U. S. Army Ordnance Department.

Gorgas, October 8, 1861, Official Records, Ser. 1, v. 4, 674-675.

¹⁵ Gorgas to Randolph, May 1, 1862, quoted in Vandiver, Ploughshares into Swords, 112.

¹⁶ Some definition of terms is needed here. "An arsenal in the strictest sense was a depository which had under its supervision an armory (which did the manufacturing of arms), a laboratory (which made ammunition as well as setting standards and construction procedures), and a depot (which was located at some detached place and could have the missions of collection, repair, and issue of arms)." Mark Mayo Boatner, The Civil War Dictionary (New York: David McKay Company, Inc., 1959), 27; It should be noted "that while basically this setup remained the same, exigencies of war caused many changes. Some Depots became Arsenals and viceversa, while some establishments such as Holly Springs and the Briarfield Arsenal melted away completely." William A. Albaugh III and Edward N. Simmons, Confederate Arms (New York: Bonanza Books, 1957), 76.

¹⁷ Josiah Gorgas, "Notes on the Ordnance Department of the Confederate Government," Southern Historical Society Papers 12 (1884): 87-89.

In May 1862, Gorgas gained Mallet as an ally in his battle for system, uniformity, and bureaucratic control of ammunition production. Although on Ordnance duty, Mallet served with his home brigade in the Battle of Seven Pines on May 31, 1862.¹⁸ Front-line service did not keep the new ordnance captain from inspecting the nearby Richmond arsenal on May 27. Mallet discovered several deficiencies. He reported to Gorgas that the Gardner machine used to make bullets "frequently" molded the minié ball in "imperfect form." Furthermore, he suggested, the process of filling small-arms cartridges with powder needed improvement in accuracy because the powder loads varied considerably, thus making the same rifle fire at a different force. Based on his knowledge of technology, Mallet offered solutions. For example, he found filling percussion caps by hand inefficient and suggested mechanization to permit "the filling [of] several hundred caps at a single operation."¹⁹ In the area of operations and organization, Mallet,

¹⁸Mallet, "Memoranda of My Life," 6-7.

¹⁹Mallet to Gorgas, May 27, 1862, "Letters Sent Superintendent of Laboratories, 1862-1865," War Department Collection of Confederate Records, Record Group 109, chapter IV, volumes 24, 28, National Archives, Washington, D.C. (from microfilm copy E502, reel 2a located at Amelia Gorgas Library, University of Alabama, Tuscaloosa); Hereafter cited as Superintendent Letters; The Gardner machine was invented by Frederick J. Gardner of North Carolina. The Confederate Ordnance Manual of 1863 describes the Gardner machine in a footnote: "A method of attaching the paper cartridge directly to the ball. . . ." Although the machine saved time and paper, complaints from the field about the cartridges led to its cancellation. Gardner received a Confederate patent for his invention, but a search did not locate a U. S. patent. The Ordnance Manual for the Use of the Officers of the Confederate States Army (Evans & Cogswell, 1863; reprint,

like Gorgas, believed centralization--both for strategic and operational reasons--the most pressing need. "The point," Mallet wrote Gorgas, "which seems to require most immediate attention, and the importance of which overshadows that of all others, is the desirability--not to say pressing necessity--of removing, without delay, this entire Laboratory to some other locality--secure for the present, and, as far as can be judged, for the future, from disturbance by the enemy . . . to [create] for reliable instead of possibly precarious supply."²⁰

Once Mallet began full-time duty with the Ordnance Bureau, Gorgas sent him to inspect arsenals throughout the South.²¹ Gorgas directed that

Dayton, Ohio: Morningside Bookshop, 1976), 253 (page references are to reprint edition); Richard N. Current, ed. Encyclopedia of the Confederacy (New York: Simon & Shuster, Inc., 1993), v. 4, 1469-1471 "Small Arms: Munitions," by Dean S. Thomas; CSA Patent Office Reports, "Patent 12, 08/17/1861 Frederick J. Gardner of Newbern, NC for Cartridges." Only a list remains of the 266 Confederate patents issued because the Confederate Patent Office was burned upon the evacuation of Richmond. For a discussion of the Confederate Patent Office and an entire list of Confederate patents see Kenneth W. Dobyns, The Patent Office Pony: A History of the Early Patent Office (Fredericksburg, VA: Sergeant Kirkland's, 1997), 167-170, 207-216.

²⁰Mallet to Gorgas, May 27, 1862, Superintendent Letters; Robert E. Lee, albeit a year later when conditions of the railroad made it impossible, recognized the same need, writing Jefferson Davis, "I think, too, Colonel Gorgas should commence at once to enlarge his manufacturing arsenals, &c., in the interior. . . ." Lee to Davis, September 11, 1863 in Clifford Dowdey, ed., The Wartime Papers of R.E. Lee, with connective narratives by Clifford Dowdey (Boston: Little, Brown, and Company, 1961), 599.

²¹These orders specified the arsenal laboratories in Petersburg, Virginia; Raleigh and Fayetteville, North Carolina; Charleston, South Carolina; Augusta, Atlanta, Macon, Savannah, and Columbus, Georgia;

Mallet meet and discuss with the commander what the best distribution of work should be, examine the "order and uniformity" of ammunition production, and suggest changes to solve individual arsenal difficulties. Mallet later described the situation as "not far removed from chaos." At the end of his inspection tour, Mallet forwarded a report with recommendations for changes and improvements to the Chief of Ordnance. Such inspection and information feedback within the bureaucracy was critical to the order, efficiency, and control at the widely scattered arsenals. Gorgas' primary concern in this endeavor was to ensure that each laboratory instituted rigorous uniformity in the caliber of small arms ammunition.²²

At Petersburg, Virginia, one of the first stops on his inspection tour, Mallet surveyed a lead smelting works, which he described as "well planned," needing only "an abundant supply of ore to turn out lead in large amount and regularity."²³ In Raleigh, North Carolina, Mallet planned to examine a powder works factory erected by Waterhouse & Bowes, but he

Montgomery and Mobile, Alabama; and Columbus and Grenada, Mississippi; Mallet was then supposed to make his office in Atlanta so he would be centrally located to travel when necessary to trouble spots. Hoole, "John W. Mallet," 37.

²²Mallet, "Memoranda of My Life," 7; Vandiver, Ploughshares into Swords, 114; Beniger, The Control Revolution, 174-177; Mallet believed that inspection reports were "the most usefull [sic] in character that I have seen, stating distinctly the faults complained of, and giving means of the Arsenals from which the defective ammunition was sent out." Mallet to Gorgas, June 9, 1863, Superintendent Letters.

²³Mallet to Gorgas, June 8, 1862, Superintendent Letters.

never had the chance. When only three-fourths of a mile away from the gunpowder factory, Mallet heard "three loud explosions in quick succession." The explosion left four workmen, in Mallet's description, "horribly mutilated." The accident destroyed the stamping house as well as several other buildings, which on inspection Mallet found "most injudiciously . . . close together," an example, in Mallet's opinion, of poor planning and management.²⁴

Mallet's sense of urgency intensified at the Charleston arsenal when he discovered that it did not have any percussion cap-making machinery. In addition, cartridges for small arms went unlabeled or were mislabeled, which made logistics and shipping more difficult for ordnance officers in the field. When he arrived at Augusta, the arsenal laboratory had not yet become fully operational. Moreover, a "great want" of lead hampered the work started there, a problem that persisted throughout the Confederacy for the duration of the war.²⁵ At a meeting in Augusta, Colonel George

²⁴Mallet to Gorgas, June 11, 1862, Ibid.

²⁵Hoole, "John W. Mallet," 43; Mallet to Gorgas, June 24, 1862, Superintendent Letters. In September 1863, Mallet wrote Gorgas that "Although I trust our more immediate and pressing wants as regards Laboratory stores--especially lead--will be relieved by the arrival--now taking place--of shipments made by Major Huse . . . the difficulty of obtaining almost all the stores from the internal resources of the Confederacy has increased enormously. . . ." Because of this shortage Mallet continued, "lead we must import, and largely as no Arsenal--except Richmond--can otherwise be depended on for small-arm's ammunition." Mallet to Gorgas, September 7, 1863, Superintendent Letters; E. Merton Coulter and Wendall H. Stephenson, ed., A History of the South, vol. VII, The Confederate States

Washington Rains, who was in charge of building a large-scale factory for the production of gunpowder, agreed with Gorgas' and Mallet's assessment that a central laboratory was needed for the standardization, control, and production of ammunition. Mallet's visit to Atlanta confirmed this view. When he arrived there for his inspection of the ordnance works, Mallet discovered that the buildings rented from the city were so small, they increased the danger of fire or explosions from the large amounts of volatile ordnance materials cramped together. Due to the problems arising from inadequate space for a laboratory, the local commander had relocated most of the munitions work to "temporary wooden buildings" on the outskirts of the city.²⁶

At this point, Mallet decided quick action was needed. He sent Gorgas a list of suggestions based on what he had observed. First, because every arsenal complained of a lead shortage, the Confederacy needed to find a "workable lead vein" and begin mining at once. Second, machinery was needed to make "reliable" bullets.²⁷ Third, standardization among the

of America 1861-1865, by E. Merton Coulter (Baton Rouge: Louisiana State University Press, 1950), 204-205.

²⁶ Mallet to Gorgas, June 24, 1862, Superintendent Letters.

²⁷ Ibid.; Bullets could be manufactured in various ways. The most primitive method was casting, where molten lead was poured into a mold. By the mid-1850s machinery had been developed and constructed at Allegheny Arsenal in Pittsburgh for the production of minié ball bullets. This probably was the type of machinery that Mallet wanted. Dean S.

arsenal products required uniform molds, swages, and gauges. Fourth and most important, work should begin immediately on one large central laboratory. As Mallet wrote:

To establish at some one point a regular and permanent Ordnance Laboratory, capable of turning out work upon a large scale, and furnished with all necessary buildings, including magazines for storage of fixed ammunition, pyrotechnic products, &c., If you approve the policy . . . of putting up permanent buildings upon a liberal scale, it would seem to be time to begin the establishment of a Laboratory of permanent character at some point . . . both as to security from invasion, facilities for manufacture, and wide-spreading communications for purposes of distribution.²⁸

In early July, Mallet reiterated the need for a central location for production and experiments. He stated that the different arsenals were producing bullets of the wrong size. For example, the arms made at Charleston "were assumed at .70 and made at .673." With this idea in mind, Mallet traveled to Tuscaloosa, Alabama, to obtain drawings for an English pressed bullet machine.²⁹

Gorgas concurred with Mallet's assessment of the necessity to begin operations of a centralized laboratory and thought Atlanta a suitable

Thomas, Ready . . . Aim . . . Fire! Small Arms Ammunition in the Battle of Gettysburg (Biglerville, Pa.: Osborn Printing Co., 1981), 6-9.

²⁸ Mallet to Gorgas, June 24, 1862, Superintendent Letters; Hoole, "John W. Mallet," 47.

²⁹ Mallet to Gorgas, July 1, 1862, Superintendent Letters.

location. Atlanta, however, did not prove an ideal site for construction. Mallet listened to advice from James H. Burton, the Superintendent of Armories, who had already compared Atlanta and Macon as possible locations for a national armory and found Macon more suitable.³⁰ In August 1862, after Mallet inspected Macon, he agreed with Burton that "the advantages both as regards position and cheapness [are] decidedly in favor of Macon--at this place a most eligible spot might be secured upon reasonable terms." Mallet drew up plans for a laboratory and estimated a total cost of \$75,000. He hoped to make the laboratory large enough to replace the "hastily gotten-up and temporary" arsenals, whereupon he could issue "uniform and standard ammunition. . . ."³¹

³⁰ Vandiver, Ploughshares into Swords, 114; Burton began building a central armory in Macon in 1862. He had been employed at Harpers Ferry, Springfield, and helped set up the American System of manufacturing at the Royal Small Arms Factory in Enfield, England. Matthew W. Norman, Colonel Burton's Spiller & Burr Revolver: An Untimely Venture in Confederate Small-Arms Manufacturing (Macon: Mercer University Press, 1996), 6-7; Lynda Lasswell Crist and Mary Seaton Dix, eds., The Papers of Jefferson Davis (Baton Rouge: Louisiana State University Press, 1992), v. 7, 1861, 228; Vandiver, Ploughshares into Swords, 79, 145, 172, 247; Smith, Harpers Ferry Armory, 285n, 302n, 312; Smith, "Ante-bellum Arms Makers," 583. Burton to Gorgas, June 11, 1862; Burton to W. Graham, June 21, 1862; Burton to Gorgas, July [?], 1862; Burton to Mayor and City Council of Macon, August, 19, 1862, "Letters Sent Macon Armory, Georgia 1862-1865," War Department Collection of Confederate Records, Record Group 109, chapter IV, volumes 20, 29, and 31, National Archives, Washington, D.C. (from microfilm copy E502, reel 1a located at Amelia Gorgas Library, University of Alabama, Tuscaloosa); Hereafter cited as Armory Letters.

³¹ Mallet to Gorgas, August 12, 1862, Superintendent Letters.

As he planned a centralized laboratory, Mallet began the arduous task of introducing conformity in the production of ammunition in all the southern arsenals. He needed a better system of control. In August 1862, Mallet issued new guidelines for Confederate laboratories that addressed internal organization, security, safety, standardization, proper packaging, and record management. To obtain uniformity of ammunition, Mallet instructed that all bullets "be frequently verified by means of gauges" as well as "carefully cast and trimmed." He directed each arsenal to adhere to specific calibers for the principal arms in use by the Confederate army. As the Ordnance Department standardized weapons in the field, Mallet hoped that the wide assortment of ammunition would eventually be replaced by one standard-size bullet. "In [the] future, ball cartridges for all muzzle-loading rifled arms (as for instance the Mississippi rifle, Enfield rifle, Minie musket and Belgian rifle)," he stated, "will be made of one uniform pattern, namely, that of the English Enfield rifle cartridges (with three wrappers)."³²

³² "Rules: To be observed in the Laboratories of C. S. Arsenals and Ordnance Depots," Confederate States of America. Ordnance Bureau. Richmond S. N. 1862. Confederate Imprints, 1861-1865. Microfilm 4106, Reel 30, no. 1437. Louisiana State University, Troy H. Middleton Library, Baton Rouge, 4; These different size bullets included the Mississippi rifle (cal. .54) fabricated at .525, the Enfield rifle (cal. .577) and the Minie musket (cal. .58) at .562, the Belgian rifle (cal. .69) at .675, and the smooth-bore musket, round ball (cal. .69) at .650; Mallet also wanted an extra set of gauges "for verifying . . . the accuracy of the gauges themselves." Mallet to M. H. Wright, October 18, 1862, Superintendent Letters.

Mallet also outlined specific powder loads for each rifle as well as particular packaging and labeling for ammunition. Bundles of ammunition had to undergo inspection for “neatness and compactness” and all packing boxes had to be “made of regulation size.” Moreover, all bundles of cartridges and packing boxes required specific information printed on the box: the number of rounds, the character of the arm, the caliber, the character of the projectile, the name of the arsenal, and the year of manufacture. All of this information helped logistics and ordnance officers in the field. Furthermore, the proper labeling of boxes made it easier for Mallet to find the source of any faulty ammunition delivered to the army. He therefore could focus on the problems at arsenals whose ammunition received frequent complaints. He insisted that each arsenal implement a strict “system of accounts” that included the “amount and condition” of ammunition produced and stored for each arsenal. These accounts gave the Ordnance Department the logistical information necessary for proper distribution of ammunition to its different armies in the field.³³

Much like the managers of the railroads who faced a crisis in control because of increased distances in travel during the 1850s, Mallet implemented an organizational structure with clear lines of authority and communication, as well as specific departments to handle the myriad tasks involved in ordnance production. He clarified the chain of command at

³³ Mallet, “Rules: To be Observed,” 4-7.

each arsenal and gave the responsibility for fully tested and approved ammunition to the arsenal's superintendent. The laboratory superintendent for each arsenal answered directly to the Arsenal or Ordnance Depot's commanding officer, inspected and issued all fixed ammunition, finished fuses, and percussion caps. In addition, Mallet wanted every laboratory to be located in a building separate from the arsenal building to prevent confusion between the two operations. Within each laboratory, Mallet introduced specific departments with a foreman responsible for the operations of each branch. A large laboratory might have as many as seven departments, ranging from a carpenter's shop to a department that fabricated fuses and rockets.³⁴ Thus, Mallet implemented a departmental structure not much different from a modern corporation.

To increase safety standards, Mallet instructed each arsenal commander to build a separate room for filling small arms cartridges. He insisted upon a separate building for highly dangerous operations, such as making fulminate of mercury, filling percussion caps, driving fuses, charging shells, and for breaking up old ammunition. He directed construction of wooden floors in the laboratories with "nails . . . carefully sunk below the surface and puttied over." All of these buildings were to be

³⁴Mallet outlined the organization of a large arsenal, with a foreman for each department, as follows: carpenter's shop, tin shop, casting room (for bullets), small arms cartridges and cannon cartridges shop, fixing and packing of ammunition shop, making percussion caps and friction primers shop, and making fuses, rockets and portfires shop. *Ibid.*, 1-2.

swept "carefully" everyday to prevent gunpowder from accumulating. Only "rubber over-shoes or woolen socks" could be worn by workmen in these areas. Of course, smoking or even carrying matches were prohibited in the laboratory buildings. All lights needed for night work had to be placed outside of the buildings. Only employees were allowed on the grounds, and visitors had to be approved by the arsenal commander. Mallet also directed that every laboratory have a guard to enforce rules and prevent unauthorized persons from entering it.³⁵ These procedures created a more efficient chain of command, helped improve quality control, and reduced safety hazards. Although the struggle to achieve uniformity and an efficient system of production was far from over, Mallet's strict guidelines for arsenals and laboratories began to bring order to the various establishments that produced ammunition.

Mallet's plans for constructing a central laboratory, on the other hand, ran into insurmountable difficulties. It soon became clear that his hope of quick construction of a central laboratory would not be realized. Indeed, by the end of 1863, a manpower shortage, a lack of building materials, increasing inflation, and a deterioration of the railroad system made centralization more a goal than an accomplished fact.

At first, the building of the laboratory went well enough. In order to induce Mallet to select it over Atlanta, the city of Macon donated land.

³⁵Ibid., 2-3.

Mallet began putting together a staff to build and run the laboratory. He hired clerks as well as technical specialists, such as Captain George Little, a chemist Mallet had known from his tenure at the University of Alabama. Mallet's staff became essential in the construction of the laboratory because Gorgas mandated that Mallet make trips at least once a month to inspect the "important arsenals" as well as the "principle armies in the field and the chief fortified seaports."³⁶

Mallet prepared for the building of the arsenal in his usual methodical manner. In order to acquire enough land, he negotiated the purchase of an additional 103 acres in October 1862. He also hired an architect for the buildings and began discussions with several contractors for materials and construction. In November 1862, he started advertising in newspapers for slave labor to construct bricks for the laboratory and for white skilled carpenters to start work at the first of the year. Because the hired slaves needed to be sheltered, clothed, and fed, Mallet asked Gorgas to arrange for the Commissary Department to provide him the provisions he required. Gorgas obtained--at least temporarily--permission for the Commissary officer at Savannah to provide the needed food for the slave labor. By December 22, 1862, Mallet had completed the purchase of land

³⁶Walter A. Harris, "By Right of Conquest: The Confederate Laboratory at Macon," Georgia Bar Journal 10 (May 1948): 430; Hoole, "John W. Mallet," 55-56; Mallet to Gorgas, October 20, 1862, Superintendent Letters; Mallet, "Memoranda of My Life," 7; Mallet, "Work of the Ordnance Bureau," 9.

outside of Macon for a brickyard where he hoped to produce 35,000 bricks a day. In addition, Mallet contracted for the purchase of nails, glass, and small items such as locks, hinges, and screws. He advertised for lime and lumber in regional newspapers and completed the designs for the buildings by January 6, 1863.³⁷

At this point, however, Gorgas reconsidered his overall strategy of centralization. He worried most about the deteriorating railroad system that, he believed, actually made centralization more of a liability than an asset. Moreover, Gorgas observed the increasing scarcity of manpower. He, therefore, decided that decentralization had to be practiced with each arsenal supplying the army nearest it.³⁸ Early in January 1863, Gorgas informed Mallet of this change in policy, writing that "it would be better to go on and get results" from the existing arsenals than risk "delay in order to erect better ones." Gorgas wanted Mallet to focus all of his attention on inspecting and improving the existing arsenals, examining samples sent from each. In

³⁷ Mallet to Gorgas, October 20, 1862; Mallet to Savannah Republican, November 28, 1862; Mallet to Gorgas, December 1, 1862; Mallet to Major J. L. Locke, December 15, 1862; Mallet to Mayor and City Council of Macon, December 22, 1862; Mallet to Captain Edward Smith, December 24, 1862; Mallet to Gorgas, January 6, 1863, Superintendent Letters; Hoole, "John W. Mallet," 56, 59.

³⁸ Vandiver, Ploughshares into Swords, 115; Melton, "Major Military Industries," 314.

other words, he emphasized making better ammunition at the scattered arsenals, rather than constructing a large centralized laboratory.³⁹

Gorgas' decision to modify the organization of ammunition production was both a rational and pragmatic solution based on the changing conditions caused by the war. Gorgas saw decentralization as a more efficient way to arm the armies in the field. Mallet, on the other hand, did not agree with this policy change because his conception of how best to manufacture ammunition depended on the central laboratory. He wrote Gorgas that "every step that I have taken has been with a view to . . . founding a 'regular and permanent' Laboratory establishment--This alone was called for by the orders I had received. . . ."⁴⁰ Gorgas replied that "your progress and the energy displayed is satisfactory," but, he continued, the situation had changed, and it was now more important to get the army ammunition rather than spend excess resources on a planned, but not yet constructed, laboratory. "I must caution you not to extend your plans too much," on the Macon laboratory, Gorgas wrote, because "I fear you will attempt what may delay results [in ammunition production], which are most important."⁴¹

³⁹ Edward B. Smith to Mallet, January 14, 1863, quoted in Vandiver, Ploughshares into Swords, 158; Melton, "Major Military Industries," 313.

⁴⁰ Mallet to Gorgas, January 19, 1863, Superintendent Letters.

⁴¹ Gorgas to Mallet, January 22, 1863, quoted in Vandiver,

Despite these instructions Mallet still tried to continue, without hindering his inspections, the construction of the works. Gorgas, it appears, gave his tacit approval to the continuation of construction as long as it did not interfere with implementation of standardization at the other arsenals. As instructed, Mallet completed temporary works for the production of percussion caps, but his construction of the permanent laboratory slowed considerably.⁴² He found himself hampered at every turn. By April 1863, because of his need for laborers and because of increasing inflation, he had to offer \$20 a month for slave labor. The Commissary Department cut back on the regular army ration supplied for each slave. Mallet complained that "its present diminished form proved quite insufficient to support Negro laborers at hard work."⁴³ These problems meant delays, but the most significant problem remained "the impossibility of procuring transportation over the railroads." By June, however, enough lime had arrived to continue the brick work and enough lumber was on hand to allow limited carpentry work on the floor.⁴⁴ In September 1863, Mallet reported to Gorgas

Ploughshares into Swords, 159.

⁴²Melton, "Major Military Industries," 315; Vandiver, Ploughshares into Swords, 158-161; Hoole, "John W. Mallet," 62.

⁴³Mallet to D. M. McIntyre, April 28, 1863; Mallet to Gorgas, February 24, 1863, Superintendent Letters; Vandiver, Ploughshares into Swords, 164.

⁴⁴Mallet to Gorgas, April 1, 1863; Mallet to Gorgas, February 21, 1863, Superintendent Letters; Melton, "Major Military Industries," 430-431.

that "the rate of progress is slow--the great difficulty being the want of bricklayers of whom--good workmen--I find it impossible to procure a sufficient number."⁴⁵

The conditions for maintaining labor continued to worsen. Mallet could no longer promise adequate care of slaves, as the Commissary Department cut back further on supplies. "It is probable that an arrangement may be made by which the government will supply shoes and even clothes," Mallet stated honestly to one slave owner, "but this I cannot yet promise." Many slaves ran away, and injury, sickness, and pregnancy also took their toll on the labor force.⁴⁶ As the year 1864 dawned, the situation had become so desperate that Mallet begged for permission to impress slaves, which he finally received in June 1864.⁴⁷

Nor was the situation much better for skilled white laborers needed for bricklaying, carpentry, and ordnance production. In September 1863,

⁴⁵ Mallet to Gorgas, September 7, 1863, Superintendent Letters.

⁴⁶ Mallet to A. M. Lockett, November 20, 1863; Mallet to Thomas Hardeman, July 30, 1863; Mallet to Gorgas, February 24, 1863, and *passim*, *Ibid*; Melton, "Major Military Industries," 429-430; Burton to W.H. Doughty, February 25, 1863, Armory Letters; For an excellent discussion of the transformation of the paternalistic master-slave relationship in the urban-industrial climate of Macon and Mallet's dealings with slaves and slave-owners see Joseph P. Reidy, From Slavery to Agrarian Capitalism in the Cotton Plantation South: Central Georgia, 1800-1880 (Chapel Hill: The University of North Carolina Press, 1992), 108-135.

⁴⁷ Reidy, From Slavery to Agrarian Capitalism, 130.

Mallet complained of wage competition between departments and the high inflation rate. He foresaw that "unless permitted to raise the wages paid here I feel almost satisfied that the detailed men will all ask to be returned to their companies and the exempt men will go to seek other employment from private sources (which they can very readily find)."⁴⁸ By the end of November, Mallet could not supply shoes or clothes to his workers and his medical supplies became scarce. In fact, Mallet reported early in 1864, his skilled labor found it difficult to procure "the bare necessities of life at their present rate of wages."⁴⁹

Mallet's supply of building materials diminished over the same period of time as well. The railroad system, however, cannot take all of the blame for the inadequacy of supplies. Lumber needed for the laboratory went instead to the building of slave quarters. Slate intended for the laboratory's roof was accidentally sent to the wrong location. Other problems included delays caused by the contractor's inability to furnish

⁴⁸ Mallet to Gorgas, September 3, 1863, Superintendent Letters; Burton, facing the same problems in building the Armory, wrote Gorgas: "I am having some trouble with the men employed in this Armory in regard to the question of wages—I am paying \$4.00 per day to first class machinists, Blacksmiths, Pattern Makers &c. . . . The men want to be paid the same rates of wages that are now paid in Richmond which they state are higher than the rates here—" Burton to Gorgas, March 17, 1863, Armory Letters .

⁴⁹ Hoole, "John W. Mallet," 62; Mallet to Gorgas, February 18, 1864, Superintendent Letters.

materials on the prescribed delivery dates.⁵⁰ Furthermore, the constant rains during the summer of 1863 "ruined large quantities of un-burned bricks, and greatly retarded the operations of the brick yard." Also, carrying out Gorgas' orders to visit the important arsenals, Mallet believed, had "somewhat retarded the general progress of the work. . . ." Even so, he reported, "I have by your orders made it secondary to the pressing claims of the active laboratories."⁵¹

Despite Mallet's mounting difficulties in building a centralized laboratory, he made steady progress in improving the quality of ammunition produced at the active arsenals. His original orders had directed him to visit each arsenal at least once a month, but Mallet found such frequent inspections "quite impossible to . . . accomplish." Instead, he only inspected the arsenals that experienced significant difficulties. He monitored the production standards of all the arsenals by receiving monthly samples from each and then testing the accuracy on his master gauges. Mallet's correspondence with the many arsenals was voluminous and showed his attention to detail. He measured and weighed all of the samples received and sent back ten- to fifteen-page reports on the specific weaknesses

⁵⁰Mallet to Gorgas, May 7, 1863; Mallet to Wadley, Jones and Company, June 26, 1863; Mallet to Dever, May 29, 1863; Mallet to Wood, Meador, and Company, June 9, 1863, Ibid.; Melton, "Major Military Industries," 371-374, 438.

⁵¹Mallet to Gorgas, August 3, 1863, Superintendent Letters.

of the ammunition samples and explained where improvements should be made.⁵²

While Mallet's quality control and record keeping brought the different arsenals into closer approximation of standards, some arsenal

⁵²Mallet had directed Caleb Huse, a Confederate agent in Europe, to purchase these "accurately tested steel guages [sic]," and he provided each arsenal with them so all had the same measuring system. Mallet, "Work of the Ordnance Bureau," 8-9; Mallet informed Gorgas in May 1863 that he had issued the "principle Ordnance Depots new gauges for the Enfield pattern" bullet. Mallet to Gorgas, May 14, 1863, Superintendent Letters.

Mallet sent out critiques of the samples each month to the arsenal commander and to Gorgas, *passim*, Superintendent Letters. An example of Mallet's inspections is the following abbreviated report to Gorgas:

"Colonel: I have the honor to submit the following summary statement of the principal points deserving notice in the results of inspection just made of monthly samples of small arms' ammunition, friction primers, &c. for May 1st.

Richmond Arsenal—Only 85 grains of powder are used for the charge of the smooth-bore musket with round ball, instead of the standard 100 grs. The bullets for Miss. rifles, Enfield rifle, and rifle musket I still think too large in view of the danger of 'jamming' in the barrel of a foul gun. The use of the recently issued guages having been suspended by your order there is no rule on the subject. Deep flaws are observable in the bottom of the cavity at base of conical bullets from Garduers' machine [probably Gardner's machine], owing to defective molding—they are likely to cause the ball to tear on discharge. . . .

Lynchburg Ordnance Depot—charge of powder used for Enfield rifle but 61-62 grs. instead of 75-cartridges made on Spillmans' plan, but folding the paper exclusively without tying—very neat in appearance (but objectionable from the difficulty with which the ball is disengaged from the paper? . . .

Atlanta Arsenal—Very well made cartridges (of old U.S. pattern) with two wrappers. Several caps exploded but feebly (defective drying after varnishing?). Friction primer tubes of brass--soldered--objectionable on account of danger of splitting and spiking the gun--Friction composition or powder was flawed, as several tubes 'hung fire.' Loops on wires not large enough to receive hook of lanyard freely." Mallet to Gorgas, May 11, 1863, Superintendent Letters.

commanders chaffed under his demands for perfection. For instance, Colonel J. L. White of the Selma, Alabama, arsenal complained about the rigid requirements for the filling of powder cartridges. He asked why "a few grains" mattered anyway? Undeterred, Mallet responded:

I am aware that it is difficult to obtain absolute uniformity in the weight of charges filled by measure--such uniformity should however be aimed at, and pains taken to instruct the fillers of cartridges to make the charges as nearly equal as possible. . . . I cannot think it an unimportant matter that the amount of powder used should vary by "a few grains" more or less than the proscribed quantity.⁵³

Nevertheless, on the day he responded to White, Mallet wrote to Gorgas of the plight arsenal commanders were having in attempting to meet the Department's strict standards:

A good deal has been done towards improving and rendering more uniform our ammunition, but much still remains to be done--There are difficulties almost without number in the way of even slight changes and improvements under our present circumstances, and it is difficult to get commanding officers--harassed by daily obstacles of every kind--to make the changes required unless they are convinced of their necessity.⁵⁴

Still, Gorgas remained optimistic about the increasing uniformity of Confederate ammunition. He expected eventually to enforce his June 9, 1862, requirement that all Ordnance arsenals adopt the .577 caliber of the

⁵³ Mallet to White, December 5, 1863, Superintendent Letters.

⁵⁴ Mallet to Gorgas, December 5, 1863, Ibid.

English Enfield rifle.⁵⁵ In a related move, Mallet began to test bullets of different sizes for the Enfield rifle. He found the .576 diameter bullet made in most arsenals "excessive" in size. "[A]lthough they can be fired from the .58 rifled musket, or even from a (clean) Enfield," he wrote, "they would in all probability soon begin to 'jam' in the barrel as the piece became foul." The use of black powder that caused fouling, the filthy conditions of combat, and the inability to clean weapons during the heat of battle, apparently convinced Mallet that a smaller bullet was necessary. He experimented with a smaller caliber bullet that could "easily" drop down the barrel even when fouled. Although the lighter bullet tended to fire low, Mallet maintained that was not a problem because soldiers tended to fire high in combat. Besides, Mallet believed, it would be better to "accept such inferior accuracy of fire than run the risk of having all fire stopped by the jamming of a bullet in the gun." He eventually concluded that .560 worked well

⁵⁵ Vandiver, "Makeshifts," 187; Vandiver, Ploughshares into Swords, 115-116; Historian Maurice K. Melton argues that "Gorgas would soon have second thoughts" on this circular because the caliber in the English Enfield being imported was .577, but the Confederate Enfield, basically built on the American Springfield Pattern (which was based first on the British Enfield) had a caliber of .58. The English Enfield loaded the cartridge paper with the ball, but the Confederate Enfield had separate cartridges between powder and ball, so the ball was loaded "naked." Thus, the size of the balls should be different. The size was not a problem at first because the Enfield bullet with paper fit the bore reasonably tightly in the Confederate Enfield. By 1863, however, the Confederacy had a paper shortage. In addition, the smaller English size minié ball became the object of complaints about accuracy because it did not fit tightly in the bore. Melton, "Major Military Industries," 324-337; Frederick Wilkinson, ed., The Illustrated Book of Guns and Rifles (New York: Hamlyn Publishing, 1979), 84, 89.

enough to prevent jamming without unduly reducing the accuracy of the Enfield and rifled muskets.⁵⁶

Mallet's proposal for smaller bullets met with some criticism. Two lieutenants, Dinwiddle and Tucker, tested Mallet's smaller gauged Enfield ammunition. They judged the bullets too small, due to excessive windage and inaccuracy. Mallet was unimpressed with their findings. They presented, he wrote wryly, "no evidence whatever . . . of any other cause of inaccuracy than extremely bad marksmanship."⁵⁷ Colonel White of the Selma arsenal also questioned the size of the smaller gauged bullet. His experiments showed there was no difficulty in loading the smaller bullet with a rifle fouled by 100 firings, but because accuracy fell sharply, he concluded that the ball must be too small. Mallet found White's conclusion "remarkable." "That this conclusion shall be logically drawn," he responded, "it obviously must be assumed that continued firing (at any rate up to 100 rounds) ought to cause good ammunition to 'jam' in the barrel of the gun." That, Mallet thought, had been the whole point, because "the prevention of such difficulty in loading was the very object in view in reducing the calibre of the balls, and as I certainly did not anticipate that any question could arise as to the desirability of facilitating loading. . . ." Besides,

⁵⁶ Mallet to Gorgas, April 17, 1863, Superintendent Letters; Melton, "Major Military Industries," 304, 326.

⁵⁷ Mallet to Gorgas, April 27, 1863, Superintendent Letters; Melton, "Major Military Industries," 335-336.

Mallet argued, the accuracy did not fall until after 300 yards, and he doubted the average line of fire between infantry lines was farther than that distance. To buttress his argument, Mallet reported that he knew of soldiers in the field who sought out Mississippi rifle ammunition (cal. .54) for their Enfield rifles and rifled muskets (cal. .577 and .58 respectively).⁵⁸

Despite these complaints, Mallet won support from the Chief of Ordnance to issue the gauge at .560. As a result, standardization improved. It did not last, however. By 1864, paper shortages and field complaints about the English Enfield cartridges not fitting well into the cartridge boxes, thus exposing them to the weather, undermined Mallet's efforts. As a result,

⁵⁸ Mallet to Gorgas, May 8, 1863, Superintendent Letters; Melton, "Major Military Industries," 381-382; Mallet's primary concern with jamming was "not how many rounds of ammunition can be fired from a clean musket . . . but how many rounds will a soldier probably be able to fire from a gun not previously in the best condition, loaded hastily in the excitement of battle, with ammunition more or less smeared with powder & grease from shaking about in the cartridge box and certain therefore soon to foul the gun to a serious extent." He went on to state that "giving the results of inspection of ammunition for May I said that I could not help still thinking the Miss. rifle bullets and old size Enfield bullets too large. . . ." Mallet to Gorgas, June 9, 1863, Superintendent Letters. It is interesting to note that this debate mirrors in some ways the debate over cannons in 18th-century France. In his work, Alder shows that "technological facts" are "ambiguous." Alder, Engineering the Revolution, 87-112; Using this idea, Mallet and White had differing views of the "technological facts" regarding the proper size of bullets. One of the flaws in the Ordnance Department's organization concerned Mallet's position of ensuring quality control. He could not issue direct orders to the arsenal commanders, many of whom outranked him. Mallet inspected the materials and then forwarded his findings to Gorgas. Mallet had to convince the arsenal commanders of the need for uniformity, and had to encourage Gorgas to issue directives. Melton, "Major Military Industries," 514-516.

Gorgas, ordered a return to the U. S. pattern of ammunition. Mallet cautioned Gorgas "that all the bullet moulds, compressing dies, and swages now in use will have to be changed, and this involves . . . serious interference with other work." Nevertheless, Mallet realized that Gorgas had no alternative. Consequently, he forwarded Gorgas' orders, despite the harm it would do to standardization.⁵⁹

Besides attempting to standardize small-arms ammunition, Mallet also worked to improve artillery shells. In August 1862, after less than four months on ordnance duty, Mallet suggested the use of a better anti-personnel projectile. He had observed that, when artillery shells exploded, there was no set size of pieces for the projectile. Mallet concluded that, when the shell broke into "numerous" pieces, the "destructive effect" became "insignificant." The resultant small pieces did not have enough force to kill. On the other hand, if the shell broke into two large pieces, the chances of hitting the target greatly diminished. Therefore, Mallet reasoned, the shell should break "into as many equal fragments of the given size . . . and that these fragments should be projected as equally as possible in all

⁵⁹ Mallet to Gorgas, April 2, 1864; A year earlier Mallet had written Major M. H. Wright that "suitable paper stands in the way of making Enfield cartridges after the English pattern without too great a reduction of the calibre of the bullet--When proper paper for these cartridges cannot be had we shall have to make the old U. S. pattern." Mallet to M. H. Wright, April 23, 1863, Superintendent Letters; Melton, "Major Military Industries," 476-477.

directions about the centre of explosion."⁶⁰ Always the scientist, Mallet developed the polygonal shell. His shell broke along designed weaknesses or "lines of easy fracture," rather than along lines of weakness from imperfections of the mold or iron defects. Mallet designed the structured weakness by making the shell with sharp corners and straight lines in a six- or eight-sided prism shape. The fragments exploded evenly, the size of each calculated to be large enough to kill a man or a horse. The new shell became popular, and Gorgas introduced it for general artillery use.⁶¹

Mallet also improved the accuracy of timed fuses, the loading of percussion caps, and the quality of friction primers.⁶² In the summer and

⁶⁰ Mallet to Gorgas, August 23, 1862, Superintendent Letters.

⁶¹ "Memorandum: In Regard To Shells With Polygonal Cavities," Confederate States of America. Ordnance Bureau. Circulars from C. S. Central Laboratory. (Ordn.), Macon, Ga., Richmond. January 21, 1863. Special Collections Department, Robert W. Woodruff Library, Emory University; Vandiver, Ploughshares into Swords, 192; Melton, "Major Military Industries," 308-310.

⁶² Mallet, "Work of the Ordnance Bureau," 9, 14-15; Mallet to Colonel P. Stockton, November 13, 1862, Superintendent Letters; Melton, "Major Military Industries," 460-479 and *passim*. Mallet also worked to improve the identification of ammunition boxes. For example, he wrote the commander of the Arsenal in Richmond: "During my recent visit to Charleston I found a number of boxes of 10 inch Columbiad shell (filled) which were not marked with the name of any Arsenal or with the date of fabrication. On examination of Invoices, &c. it was ascertained that they came from Richmond Arsenal. It is essential in order to enable mistakes and faults to be corrected that the rule requiring the Arsenal and date of fabrication to be always marked upon the boxes should be uniformly observed. . . . The importance of attention to rule in these little matters is not seen unless the

fall of 1863, he made a concentrated effort to solve the problem of timed fuses. From a telegraphic instrument manufacturer in South Carolina, he ordered a specially made electro-magnetic timer that allowed him to measure accurately the rate of burn on timed fuses. With this device, he worked to correct premature shell explosions by firing a number of experimental rounds at James Island.⁶³ Mallet eliminated some of the premature explosions by finding that "quick-match priming" created a more "certain" burn and that it helped to "'ream' out about an eighth of an inch of composition from the head of the fuze." These two improvements brought "excellent results" in his testing.⁶⁴

products of several different Arsenals are examined side by side or—as they often are in the field—mixed together." Mallet to Lieut. Col. W. LeRoy Broun, September 3, 1863, Superintendent Letters .

⁶³ Mallet to C. T. Mason, June 30, 1863, Superintendent Letters; Dunnington, "A Sketch of Dr. John William Mallet," 184; Mallet found James Island an efficient place for systematic testing because "I have no suitable range here [Macon], and moreover dislike to waste ammunition in merely experimental firing when it is possible to use it against the enemy." Mallet to Col. G. W. Rains, October 7, 1863, Superintendent Letters; Major Edward Manigault wrote on August 23, 1863 that, "Major Mallett [sic], of the Confederate Ordnance Department, came to Legare's Point for the purpose of inspecting, and, if possible, remedying the defects of the fuses and other ordnance stores. He remained, witnessing the firing &c., for two hours, and had full evidence of the worthlessness of the fuses." Report Maj. Edward Manigault, C.S. Artillery, Commanding Artillery at Legare's Point, James Island, August 28, 1863, Official Records, Ser. 1, v. 28, pt. 1, 557.

⁶⁴ Mallet to Gorgas, July 14, 1863; Mallet to J. T. Trezevaut, August 30, 1863; Mallet to Gorgas, October 3, 1863, Superintendent Letters.

Although the Ordnance Department had taken significant steps toward increasing uniformity by 1863, Mallet failed to receive the modern machinery that would have improved production. To equip the slowly progressing Central Laboratory with the machinery required for large-scale production, he depended on Confederate agents in Europe. In April 1863, Gorgas sent Colonel James H. Burton, Superintendent of Armories, to procure rifle-making machinery in Europe. Along with purchases of machinery for the Armory, Burton ordered for Mallet bullet making machines, plug making machines, percussion-cap machines, and friction primer equipment from Greenwood and Batley in Leeds, England.⁶⁵ Fraser, Trenholm, and Company shipped the machinery in mid-1864 to Bermuda. Unfortunately, blockade-runners no longer made the trips from Bermuda to the South with ease. The increased vigilance of federal naval patrols and

⁶⁵The choice of Burton made sense because of his vast experience in the field of arms production. Frank E. Vandiver, "A Sketch of Efforts Abroad to Equip the Confederate Armory at Macon," The Georgia Historical Quarterly 28 (March 1944): 33-37; See also Burton's after report of the mission to Gorgas, Burton to Gorgas, October 30, 1863, Armory Letters; Mallet, "Work of the Ordnance Bureau," 5; Mallet to Gorgas, September 7, 1863, Superintendent Letters; Burton was quite pleased with the machinery he ordered for Mallet. He wrote, "I have been authorized by Major Huse to include in the contract a bullet making machine . . . the same as those at Woolwich Arsenal; and they are to be delivered with the first lot of machinery." Burton also ordered "excellent machines for moulding shot & shell with unskilled labour, resulting in great economy of cost. It might be well to order a few of these machines for Capt. Mallet. . . ." Col. Jas. M. Burton, Leeds, England, to Col. J. Gorgas, Richmond, July 11, 1863, April 13, 1863, Burton Papers, Ramsdell Collection, The Center for American History, The University of Texas at Austin (microfilm roll 398). Hereafter cited as Burton Papers.

the loss of important ports made the run difficult and dangerous. Consequently, only a small proportion of the machinery reached the Confederacy.⁶⁶

The inability to deliver the machinery rapidly became a moot point with the Confederacy's collapse. In May 1864, Major General William T. Sherman initiated his advance into Georgia. Men were called from all stations to meet the challenge. As a result, fewer workmen were available. "As to 'impediments,'" Gorgas reported, "I know of none which I cannot overcome, except the persistent and continuous interference with our workmen on account of military operations. If this source of disorganization and weakness be not finally disposed of, there is no possibility of sustaining the operations of the Bureau."⁶⁷ He also argued for the exemption of skilled mechanics from military service. Much of the

⁶⁶ Burton to Gorgas, July 30, 1863, Burton Papers. A good overview of blockade running is Stephen R. Wise, Lifeline of the Confederacy: Blockade Running During the Civil War (Columbia, South Carolina: The University of South Carolina Press, 1988); See also Frank E. Vandiver, ed., Confederate Blockade Running through Bermuda, 1861-1865: Letters and Cargo Manifests (Austin: The University of Texas Press, 1947).

⁶⁷ Gorgas to Breckinridge, February 9, 1865, in Robert G. H. Kean, "Resources of the Confederacy in February, 1865," Southern Historical Society Papers 2 (1876): 58; Gorgas wrote in his diary on January 31, 1864: "In such a war as this--a war for national existence the whole mass of the nation must be engaged. It must be divided into those who go to the field and fight, & those who stay at home to support the fighting portion, supplying all the food, and material of war. . . . It is simply absurd to call on all to fight. Some must labor or all will starve." Wiggins, The Journals of Josiah Gorgas, 92.

arsenals' machinery laid idle, due to the loss of skilled labor.⁶⁸ Moreover, the need for slave-labor in Atlanta created a labor shortage for the construction of the Macon laboratory.⁶⁹

The weaknesses of the South at the outset of the war--the lack of a well-developed industrial infrastructure and a smaller population--finally caught up with the Ordnance Department. For the army to allow its men work in ordnance duty, it would have to increase its numerical disadvantage on the battlefield. Diarist John B. Jones underscored the dilemma, when he reported on March 1, 1865, that General Lee "rebuked" Brigadier General Gorgas "for constantly striving to get mechanics out of the service. . . . [T]he time has arrived when the necessity of having able-bodied men in the field is paramount to all other considerations."⁷⁰

In his final year at Macon, Mallet confronted the Ordnance Department's extreme difficulties. In early 1865, he completed the Central Laboratory's "front line of buildings." Mallet considered them ready for the

⁶⁸Gorgas to Seddon, October 13, 1864, in Kean, "Resources of the Confederacy," 59-60.

⁶⁹Gorgas to Seddon, February 2, 1865, *Ibid.*, 63; Gorgas to Seddon, October 13, 1864, *Ibid.*, 59; In August 1864, General Hood directed that all of Mallet's slave labor employed in construction of the laboratory be sent to Atlanta. Hood to Cuyler and Mallett [sic], August 1, 1864, Official Records, Ser. 1, v. 38, pt. 5, 939.

⁷⁰John Beauchamp Jones, A Rebel War Clerk's Diary, condensed, edited and annotated by Earl Schenck Miers (New York: Sagamore Press, 1958), 510.

machinery stranded in Bermuda, but he estimated that he needed another forty smaller buildings for a complete laboratory complex.⁷¹ When Sherman threatened Atlanta, the percussion-cap machinery and other ordnance equipment along with workmen were moved to Macon. As a result, the Macon operation began to manufacture friction primers as well as percussion caps. In addition, two small companies and one section of artillery protected the temporary arsenal, the incomplete laboratory works, and the Central Armory in Macon. Most of the men in the companies were local workers. Only a few soldiers in the line of trenches surrounding the city had combat experience. In July 1864, General George Stoneman's cavalry advanced upon the town. The Confederate force at Macon, however, successfully repulsed the raid.⁷²

Despite this successful defense, the situation only worsened in Macon. The Ordnance Department encountered greater difficulties in meeting the munitions needed by the army. In August 1864, Mallet telegraphed Gorgas that the Macon arsenal could not meet "heavy requisitions from several quarters."⁷³ On September 5, two days after Sherman sent notice to

⁷¹Mallet, "Memoranda of My Life," 7-8.

⁷²Ibid., 7-9; Mallet, "Work of the Ordnance Bureau," 14-17.

⁷³Mallet to Gorgas, August 23, 1864, "Telegrams Sent Superintendent of Laboratories, 1863-1865," War Department Collection of Confederate Records, Record Group 109, chapter IV, volume 52, National Archives,

Washington that "Atlanta is ours, and fairly won," Mallet sent the disturbing news to Gorgas that General Hood had blown up his ordnance train before departing Atlanta.⁷⁴ With Atlanta under federal control, Mallet began shipping "surplus laboratory stores" to what seemed a safer location at Selma, Alabama. His difficulties increased when, in October, he lost one-fifth of his workmen to conscription. Things got even worse. The next month Sherman began his "March to the Sea."⁷⁵ Because Mallet thought the Union army intended to destroy Macon, he loaded his machinery on

Washington, D.C., (from microfilm copy E502, reel 3a in the Amelia Gayle Gorgas Library, University of Alabama, Tuscaloosa); Hereafter cited as Superintendent Telegrams.

⁷⁴Sherman to Major General H. W. Halleck, September 3, 1864, Official Records, Ser. 1, v. 38, pt. 5, 777; Mallet to Gorgas, September 5, 1864, Superintendent Telegrams.

⁷⁵Mallet to White, September 6, 1864; Mallet to Gorgas, October 25, 1864, Superintendent Telegrams; In 1864-1865, the Confederate Government expanded the draft pool, and fewer waivers were given to workers for deferment from service. General Orders, No. 82 stated that "The Chief of the Bureau of Ordnance will, without delay, take measures to place in the field one-fifth of all the men employed in his department (including contractors and their employes) of the classes specified. . . . To this end he will direct the several officers in charge of arsenals, workshops, depots, &c., to turn over to the nearest enrolling officer, by list, showing their ages, occupation, and residence, such proportion of their employes . . . of the class above referred to as will constitute in the aggregate one-fifth of the whole number in the said classes. . . . Three days are allowed for the execution of this order after its reception at any post or station of the Ordnance Department." General Orders No. 82, Adjutant and Inspector General's Office, October 20, 1864, Official Records, Ser. 4, v. 3, 741.

railroad cars for Savannah. The effort was wasted, however, because of damage to the railroad line.⁷⁶

Under these adverse conditions the laboratory at Macon continued to make ammunition, although Mallet had no money to pay his men. In addition, several arsenals almost ground to a standstill for want of lead. Even with the removal of lead pipes from Mobile, Alabama, it remained a critical need.⁷⁷ Still, Mallet continued to produce percussion caps and friction primers. Because of the circumstances, however, he had to decide whether to move his equipment. Six days after Lee's surrender, he telegraphed Colonel George Washington Rains in Augusta that "General Mackall advises that, question of moving cap factory or not be decided at once. Enemy are moving on Columbus. Where is General Gorgas?" Unbeknownst to Mallet, Gorgas and most of the Confederate hierarchy had fled Richmond on April 2, after news came from Lee that his lines had been broken.⁷⁸ On April 20, eleven days after Lee's surrender, Mallet once again

⁷⁶ Mallet to Gorgas, November 21, 1864, Superintendent Telegrams; Mallet, "Work of the Ordnance Bureau," 18.

⁷⁷ Mallet to Gorgas, February 2 and 9, 1865; Mallet to J. L. Nott, February 11, 1865, Superintendent Telegrams.

⁷⁸ Mallet to Rains, April 15, 1865, *Ibid.*; Jones, Rebel War Clerk's Diary, 530-532; Amelia Gorgas, "As I Saw it: One Woman's Account of the Fall of Richmond," ed. Sarah Woolfolk Wiggins, The Civil War Times Illustrated (May 1986): 40-42; Vandiver, Ploughshares into Swords, 266-267; Wiggins, The Journals of Josiah Gorgas, 158-162.

put his men in the trenches to defend against an expected cavalry attack. The attack never came. A telegram from Generals Johnson and Sherman preceded it, "ordering an immediate cessation of hostilities."⁷⁹

Notwithstanding the South's defeat, the accomplishments of the Confederate Ordnance Department, in terms of organizational control and technological improvement, were impressive. The department made significant progress toward the standardization of ammunition and the creation of a modern bureaucratic system of production. It marshaled raw materials. It assembled, trained, and directed a large work force. It planned and built production sites. The department also established control mechanisms for the production of ammunition. This involved the arrangement of production processes, the imposition of size and quality standards, and the introduction of systematic testing and site inspections. Beyond this, it developed strict rules and procedures in packaging materials to control logistical problems, and it introduced accounting procedures for the distribution of arms. Further still, it made technological progress through the use of systematic experimentation of ammunition, timed fuses, and the polygonal shell. Accordingly, it was not a failure of vision, but defeat on the battlefield, that prevented the Confederate Ordnance Department from its full realization of modern organizational structures

⁷⁹Mallet, "Work of the Ordnance Department," 18; Mallet, "Memoranda of My Life," 9.

and technology. Indeed, during the thirty years after the war, the organizational principles that Gorgas and Mallet implemented became integral parts of the bureaucratic system of big business. With these ideas, Gorgas and Mallet would help create a New South.

CHAPTER 5

SYSTEM, TECHNOLOGY, AND CONFEDERATE GUNPOWDER PRODUCTION

For a society based on agriculture, the South made significant strides in incorporating industrial methods and ideas during the war. These organizational ideas did not die with the war but helped create a New South. An Englishman who toured the Confederacy in the spring of 1863 found that Confederate soldiers had "every variety of weapon." In Mississippi, after the evacuation of Johnston's army, he saw "great numbers of pikes and pikeheads," which reinforced his belief that the Confederacy remained in no condition to carry on the war. Once he moved into the eastern theater, however, his viewpoint changed. Besides the noticeable improvement of the arms carried by the troops, what impressed the English visitor the most was the government powder works in Augusta, Georgia. He scarcely believed the amount of gunpowder produced at the mill, entirely built after the Civil War began.¹ The Government Powder Works he viewed exemplified the strides the Confederate Ordnance Department made under

¹ Arthur James Fremantle, Three Months in the Southern States, April-June, 1863 (New York: John Bradburn, 1864), 6, 74, 106, 174-177, 225.

Gorgas and his subordinates as they began a program of home manufacture and industrialization in the hope of self sufficiency. Like the production of ammunition, gunpowder manufacturing included a variety of tasks: the procurement of raw material, large-scale machinery, skilled labor, mass production, system, control, and bureaucratic structures. As Mallet and Gorgas, George Washington Rains would also teach the lessons of war to a new generation of southerners after the war that stressed the need for system, science, and technology.

At the beginning of the war the supply of gunpowder was limited. At first, the Confederate government obtained a small accumulation of powder from a variety of sources. The initial supply came from the capture of Norfolk Naval Yard and some minor amounts located at the Baton Rouge and Mount Vernon arsenals. Gorgas estimated that in all the southern arsenals, no more than 60,000 pounds of powder existed. "The entire supply of gunpowder in the Confederacy at the beginning of the conflict," recalled George W. Rains, the head of the Confederate government's efforts to manufacture gunpowder, "was scarcely sufficient for one month of active operations." He continued that "to enter upon a great war without a supply of this essential material, and without effective means of procuring it from abroad, or of manufacturing it at home, was appalling."²

²Charles Edgeworth Jones, "Confederate Powder Works at Augusta," The Confederate Veteran Magazine 26 (January 1918-December 1918): 208;

For home manufacture of gunpowder, Gorgas decided on a two-tier effort of permanent and temporary works. Permanent works served the purpose of providing centralized, large-scale production, while temporary works scattered throughout the South met "immediate demands." Temporary works used the resources available in each region, supplied the nearest army, and could be moved quickly to new locations if the enemy approached. Temporary works, however, could not make large amounts of powder. Gunpowder needed to be produced in large quantities of high quality, a task that could only be done in a permanent, large-scale manufacturing plant with economies of scale.³

The Confederacy had some small powder mills in Tennessee, Louisiana, and South Carolina. A shortage of equipment and a lack of saltpeter, an essential element in the making of gunpowder, plagued production at these mills. At first, a variety of problems kept production at the small mills to about 300 pounds of powder a day. Therefore, a shortage of gunpowder became especially acute in the early stages of the war. Major

Josiah Gorgas, "Notes on the Ordnance Department of the Confederate Government," Southern Historical Society Papers 12 (1884): 68. George Washington Rains, History of the Confederate Powder Works (Augusta, Georgia: Chronicle and Constitutionalist Printers, 1882): 3.

³John W. Mallet, "Work of the Ordnance Bureau of the War Department of the Confederate States, 1861-1865," Southern Historical Society Papers 37 (1909): 4; Rains, Confederate Powder Works, 4; Gorgas, "Notes on the Ordnance Department," 72-73; Jefferson Davis, The Rise and Fall of the Confederate Government, vol. 1, (New York: D. Appleton and Company, 1881), 474-475.

General David E. Twiggs, the first commander of New Orleans, noted this shortage in a letter to Secretary of War Walker. "I do not wish to appear pettish or to be importunate in the matter of powder," he complained, "but if it cannot be obtained the sad spectacle will be presented to the Confederacy of the Mississippi Valley falling into the hands of the enemy because of the lack of ammunition."⁴

In order to bring about system, uniformity, control, and large-scale production of gunpowder, Gorgas turned to George Washington Rains. Rains fit the definition of a "soldier-technologist" perfectly. A native southerner, Rains was born in Craven County, North Carolina, in 1817. He received his early education at New Bern Academy. He accepted an appointment to the United States Military Academy in 1838, and quickly progressed through the cadet grades from Corporal to First Captain of Cadets. He ranked first in his class in scientific studies and third overall in his senior class. With such high achievement at the Academy, he chose the Engineer Corps as his specialty when he received his commission in 1842. Rains and Gorgas probably knew each other at West Point since Gorgas graduated in 1841, and both excelled in the same areas of study.⁵

⁴Maurice K. Melton, "Major Military Industries of the Confederate Government" (Ph.D. diss., Emory University, 1978), 41-42; Twiggs to Walker, September 6, 1861, Official Records, Ser. 1, vol. 6, 728.

⁵Twenty-Ninth Annual Reunion of the Association Graduates of the United States Military Academy at West Point, New York, June 9, 1898, 71-72

Rains' first assignment sent him to Boston where, as a young engineer, he engaged in the construction of Fort Warren and gained valuable experience in design and practical implementation of architectural plans. Despite his technological skill, Rains became bored with the "monotony" of engineering work and displayed a "predilection for the parade and excitement of military life." He petitioned General Winfield Scott to arrange a highly unusual transfer to the 4th Artillery at Fort Monroe in Virginia. Rains only served a year in artillery duty before he received orders in 1844 to teach chemistry, mineralogy, and geology at West Point, where he stayed until the war with Mexico. At the outbreak of the Mexican War in 1846, Rains requested and was transferred back to an artillery regiment. He served as Acting Assistant Quartermaster and Acting Commissary of Subsistence at a large logistical base at Port Isabel, where the

in George Washington Rains Papers, Southern Historical Collection, The University of North Carolina, Chapel Hill, North Carolina. Hereafter cited Rains Papers; Maurice Melton, "'A Grand Assemblage': George W. Rains and the Augusta Powder Works," Civil War Times Illustrated 11 (January 1973): 28; Melton, "Major Military Industries," 43-44; Rains' brother, Gabriel, was also a well-known soldier technologist. He developed the land mine during the Seminole War and also used it against Union troops during the Civil War. See, Milton F. Perry, Infernal Machines: The Story of Confederate Submarine and Mine Warfare (Baton Rouge: Louisiana State University Press, 1965); For an analysis of this debate, see Norman E. Youngblood, "'The Most Murderous and Barbarous Conduct': The Development of Mine Warfare in the Nineteenth Century American Military," (M.A. Thesis, Southwest Texas State University, 1990).

Rio Grande meets the Gulf of Mexico. He later became an aide to General Winfield Scott and an Aide-de-camp to General Pillow.⁶

After his service in Mexico, Rains accompanied Pillow back to his command in New Orleans. Once there, he received orders to travel to Florida where clashes with the Seminole Indians escalated into outright warfare. During the Seminole War, Rains' duties involved road building, bridge construction, and erection of forts. He remained in Florida for eighteen months and gained valuable engineering experience. Once the conflict ended, Rains served at a variety of posts, including Fort Hamilton, Fort Columbus, and Fort Mackinaw. In 1855, he became Commandant of Recruits at Governor's Island. Upon marriage, Rains decided to pursue engineering in private enterprise for higher pay. As president of the Washington Iron Works in Newburgh, New York, he helped design a new steam engine.⁷

In 1861, Rains made the decision to render his services to his native South. The invitations of Jefferson Davis and Gorgas played an important role in this decision. Rains pointed out that Davis, a former West Point graduate and Secretary of War, understood the need for soldier-technologists. Davis knew most of the talented people in the military,

⁶Reunion, 72-73.

⁷Ibid.; Melton, "A Grand Assemblage," 28; Joseph B. Milgram, Jr., and Norman P. Gentieu, George Washington Rains--Gunpowdermaker of the Confederacy (Philadelphia: Foote Mineral Company, 1961), 4.

which allowed him "to select his agents for the different services required." Davis and Gorgas wanted Rains to build a gunpowder factory to supply the Confederate army. Upon his arrival in Richmond, Rains received from Davis and Gorgas a virtual "carte blanche" to select a location in the interior of the Confederacy to build a permanent factory to supply gunpowder.⁸

In his new job, Rains had to perform several tasks at once. He had to select a suitable site for a permanent powder plant, design the architecture and layout, obtain the needed machinery for production of powder, and develop a continuous supply of saltpeter. At the same time, Rains had to improve the production capabilities at the small powder works in Nashville, New Orleans, and South Carolina. "I immediately left Richmond," Rains recalled,

to begin the work not waiting even for my commission in the army to be made out, which I received afterwards. Day and night for several months I almost lived on railroad cars; devising plans, examining the country for a location, hunting up material, engaging workmen, making contracts, and employing more or less every available machine shop and foundry from Virginia to Louisiana.⁹

Rains made a whirlwind tour of the South, and while looking for a suitable site, inspected the small powder works, especially the Sycamore Mill in

⁸ Reunion, 74; Rains, Confederate Powder Works, 4.

⁹ Extract of George W. Rains' speech to the Confederate Survivors' Association in Augusta, Georgia on April 26, 1882, in George Washington Rains Papers. Hereafter cited as Rains' Speech to Survivors.

Nashville. These manufacturing plants had to meet the Confederacy's immediate demands, and Rains believed "the utmost energy was required to prevent the loss of a battle by a failure in ammunition." Therefore, they required his "first attention." Upon arriving at the Sycamore Powder Mill, Rains took over the state contracts for the Confederate government and began enlarging the plant as well as improving its technology. He ordered stampers constructed to mix the ingredients of gunpowder.¹⁰

Saltpeter, however, remained in short supply in 1861, and hampered production at all the powder mills. Gunpowder required four elements: potassium nitrate and saltpeter, constituting 75 percent of the mixture, and equal parts charcoal and sulfur, making up the other 25 percent. Saltpeter included a combination of nitrates and potash lye. The nitrates could be mined from "nitrous earth" that forms naturally in limestone caves, cellars, and under buildings, or it could be manmade with the nitrates from rotting carcasses, manure, and urine. "Porous fine-grained wood" provided the ingredients for charcoal; the best type of wood in the South came from the willow that, in Rains' opinion, proved favorable over other types because it left "very little ashes when burned." The elements were mixed together either by a stamping process (used at the Sycamore Mill) that pounded the ingredients together or by a rolling method that combined the elements

¹⁰Rains, Confederate Powder Works, 4-5.

under the weight of heavy cylinders. The mixing process, Rains observed, must be done under the "most favorable conditions, when there should be the most intimate approximation of the component molecules." If the mixture contained the wrong proportions, or was not combined correctly, the explosive force became inaccurate.¹¹ Therefore, system, uniformity, and control proved critical in the production of gunpowder.

Understanding that the large-scale production of powder relied on a constant supply of saltpeter, Rains wrote a pamphlet, Notes on Making Saltpetre from The Earth of the Caves, in the hope of creating large diversified sources of this material. The booklet provided instructions on how individuals and communities could leach niter. It included details on how to prepare a barrel to hold nitrous earth, so that the niter could be separated and drained from the soil. He then went on to explain the process of combining lye with the separated niter in the proper proportion to form saltpeter. When these two compounds coalesced, the mixture was boiled in order to rid the saltpeter of any impurities, leaving it in crystal form.¹²

Rains estimated that "twelve barrels of the earth of the caves will in general, make not less than one hundred pounds of Saltpetre," and he stated

¹¹Rains, Confederate Powder Works, 16-17; Melton, "Major Military Industries," 49-50; Milgram, Gunpowdermaker of the Confederacy, 7-8; Melton, "A Grand Assemblage," 33.

¹²George W. Rains, Notes on Making Saltpetre from the Earth of the Caves (Augusta, Georgia: Steam Power Press Chronicle & Sentinel, 1861).

that even if twelve barrels produced only 67 pounds, it would still be worth \$23.45, or the equivalent of 35 cents per pound, a price the Ordnance Department would gladly pay. Published in Nashville, Richmond, and New Orleans in 1861 the pamphlet included all of the regions in the South. Rains hoped that "crude saltpetre" would "rapidly" be obtained by the efforts of private citizens and contractors throughout the South. Much of the region had rich, nitrous earth, and a survey by government officials and private individuals located numerous caves for development in east Tennessee and the northern region of Alabama, as well as the foothills of Virginia, Arkansas, and Georgia. Eventually, most of the niter caves and the collection of niter in towns fell under the control of the Nitre and Mining Bureau set up by Gorgas in 1862.¹³

The Ordnance Department fulfilled the immediate demand for saltpeter by purchasing 240 tons from the State of Georgia. In addition, several tons of sulfur that had been imported to Louisiana for use in sugar factories, met pressing needs. The efforts of Confederate purchasing agents in Europe became an important source of supply for saltpeter through the blockade. Some 2,700,000 pounds came from blockade-runners, primarily at

¹³Ibid.; Richard C. Sheridan, "Production of Saltpetre from Alabama Caves," Alabama Review 33 (January 1980): 27; Rains, Confederate Powder Works, 6; Coulter, History of the South, 206; Glenna R. Schroeder, "'We Will Support the Govt. to the Bitter End': The Augusta Office of the Confederate Nitre and Mining Bureau," Georgia Historical Quarterly 70 (Summer 1986): 289.

the ports of Charleston and Wilmington. During the same period, mining and niter beds in the Confederacy produced 300,000 pounds.¹⁴

In April 1862, Gorgas appointed Major Isaac M. St. John to handle contracts for mineral resources and the procurement of powder. This organization, called the Nitre and Mining Bureau, quickly ballooned in size and importance, and it eventually became an independent department. It also became one of the most powerful organizations in the Confederate government late in the war because of its ability to impress slaves, caves, mines, iron, and other needed materials.¹⁵

To supply niter, St. John depended on two sources. The primary source became nitrous soil from caves throughout the South. In order to mine as many areas as possible, St. John divided niter-bearing areas into districts with each district having an officer in charge. These officers hired white workmen and used slaves to mine the caves and process the soil into saltpeter. Much of the work took place in "Union districts," which Gorgas characterized as "a rude, wild sort of service"; he suggested that "the officers

¹⁴ Answer to interrogatories under resolution of Congress of July 27, 1861, from Ordnance Office, War Department, August 12, 1861, Official Records, Ser. 4, vol. 1, 555; Bell Irvin Wiley, The Life of Johnny Reb (Baton Rouge: Louisiana State University Press, 1980), 304; Rains, Confederate Powder Works, 7.

¹⁵ General Orders No. 85, Adjutant and Inspector General's Office, "AN ACT to Establish a Niter and Mining Bureau," June 16, 1863, Official Records, Ser. 4, vol. 2, 594; Frank E. Vandiver, "Makeshifts of Confederate Ordnance," Journal of Southern History 17 (May 1951): 187.

in charge of these districts, especially . . . had to show much firmness in their dealings with the turbulent people among whom, and by whose aid, they worked." Nevertheless, Gorgas recalled that with St. John's bureaucratic system, "we brought up the nitre production, in the course of a year, to something like half our total consumption."¹⁶

The second process St. John used consisted of making niter beds; he tried diligently to get every town to develop one. This manmade process used ditches approximately two-feet deep, filled with human urine, carcasses, manure, decaying vegetables, and organic liquids as active ingredients to make niter. It fermented in about a year and a half; it was then placed in hoppers and the niter drained through it. Although little niter recovery actually occurred in this fashion, it is estimated that three to four million pounds were "ripe enough to be leached" at the end of the war.

¹⁶St. John reported to Secretary of War Randolph: "On August 1 the furnaces were up and work under way at sixteen Government caves, with an average force of 272 white hands and 115 negroes. This does not include labor on private works. . . . Referring to the niter districts in detail--in Virginia fifty contracts have been closed with private parties, some of whom have worked well, but from their slow progress and the frequent loss of caves by the enemy . . . work has been undertaken on Government account. . . . In Georgia there are several niter caves in the northwestern counties--one in Bartow County, very valuable. . . . In Tennessee are several very large and rich caves. The most valuable are under hostile control. . . . In Northern Alabama the presence of the enemy has occasioned a general suspension of work, including the valuable Santa Cave. . . . In lower Alabama a vigorous effort is being made to induce planters in the limestone and marl counties to work plantation earth. . . ." St. John to Randolph, July 31, 1862, Official Records, Ser. 4, vol. 2, 26-30; Gorgas, "Notes on the Ordnance Department," 76-77.

In the area of niter production, the Confederacy made progress, and Gorgas looked at the niter beds as a long-term solution. "Our chief supply of chemicals," Gorgas admitted, "continued to come, however, from abroad . . ." but "these works, as well as our nitreries, were as much preparation against the day when the blockade might seal all foreign supply. . . ." ¹⁷

While Rains prepared plans for a centralized gunpowder manufacturing plant, the Ordnance Department signed a series of contracts to meet immediate demands. Bowen and Company near Pendleton, South Carolina, and J. M. Ostendorf of Walhalla, South Carolina, produced sulfur and saltpeter for the department. In addition, the Military Committee of Tennessee and the governor of Tennessee contracted the construction of a powder mill at Manchester. These works employed the rolling process in mixing the powder instead of the stamping process traditionally used. This process allowed Rains to experiment with different methods of refining while he built the Confederate Powder Works. ¹⁸

¹⁷ St. John wanted "to stimulate private enterprise by circular and newspaper publications, personal appeal, and instruction, and by affording facilities for work in prompt payment and a liberal supply of tools and utensils." St. John to Randolph, July 31, 1862, Official Records, Ser. 4, vol. 2, 26-27; Gorgas, "Notes on the Ordnance Department," 76-77; Coulter, History of the South, 206; Mallet, "Work of the Ordnance Bureau," 10.

¹⁸ Answer to interrogations, August 12, 1861, Official Records, Ser. 4, vol. 1, 555; Rains, Confederate Powder Works, 7; Rains originally requested stampers at Manchester, but Gorgas decided to have rollers made instead. Gorgas to Rains, September 30, 1861, Rains Papers.

Despite these efforts, the South Carolina mills produced only 300 pounds of powder a day combined, and the Nashville works proved disappointing. In a letter to Rains in September 1861, Gorgas complained that "if we could get 1200 lbs a day from the Nashville mills we should do very well, but those mills seem to be a mirage--constantly receding. . . ." In Gorgas' opinion, the plants should have been producing "400 lbs a day," but, "Wright says they will in a few days produce a 100 pounds per week--patience, patience, patience, & yet again patience!"¹⁹

The lack of standardization and control produced inferior powder at the scattered mills. Moreover, powder brought from abroad often was poor or got wet on the run through the blockade. A Confederate artillery commander along the Potomac reported that "the ammunition found in the magazine for the large guns was very indifferent." Further still, "the powder was a mixture of blasting with rifle powder." Because of this mixture, he reported, "the Armstrong gun at the same elevation would not throw a shell more than halfway across the river; then again far over the river." Another officer complained that artillery shots fell short of their mark because "of the inferiority of our powder compared to that of the enemy." Giving Gorgas confidence, however, Rains had decided on a location for the Government Powder Works and construction had begun in

¹⁹ Answer to interrogations, August 12, 1861, Official Records, Ser. 4, vol. 1, 555; Gorgas to Rains, September 30, 1861, Rains Papers.

earnest. The groundwork for high quality, uniform, mass-produced powder had been laid.²⁰

In July 1861, Rains studied the city of Augusta, Georgia, as a potential site for the powder works. "It was remarkable," he marveled, "that the most favorable conditions required in the erection of an extensive Powder manufactory, were all met at this location, and nowhere else attainable." He found many reasons for its selection. It lay deep within Confederate territory. It connected to the major railroad network. In addition, the location of the Augusta Canal, on which an old U. S. arsenal remained, provided two attractive features: it supplied water-power for the assorted buildings constructed and provided transportation during the different processes between buildings. The buildings Rains planned covered a two-mile area along the canal, with each building separated by at least 1,000 feet for safety. Spreading out the different processes in the making of gunpowder by this distance made a chain-reaction of explosions, and thus the loss of the whole manufacturing works, less likely. The Augusta Canal had little commerce or traffic which made the possibility of an accident improbable; the vicinity around the canal held a sparse population on the western part of the city limits which kept civilians at a safe distance.²¹

²⁰Wiley, Johnny Reb, 303-304; Report of Brigadier General Johnson K. Duncan to Major J. G. Pickett, April 30, 1862, Official Records, Ser. 1, vol. 6, 525.

²¹Rains, Confederate Powder Works, 10-11; Milgram,

Rains also considered the availability of labor, especially mechanics, when he chose Augusta as the site for the Powder Works. He noted that having the works near a populated center allowed for the recruitment of skilled labor. Fortunately for Rains' works, the beginning of the hostilities left many manufacturers and builders idle and skilled labor "thrown out of employment, which enabled contracts to be made advantageously at the usual prices"—a luxury that would not be present in the later stages of the war. A quick start in construction proved important in procuring the needed materials and labor.²²

The basis of the plans for the Government Powder Works relied on "an invaluable pamphlet," written by Major J. Fraser Bradley, Superintendent of England's Waltham Abbey Works. This pamphlet became Rains' guide in designing the Powder Works, "and the entire process and machinery employed at that factory, the best existing in any country, was succinctly stated." However, Bradley's explanation of the Waltham Works did not include drawings, working plans, or any details of how he organized the layout of the buildings. Rains failed to find any publication with these specifics and therefore "was thrown upon" his "own resources to supply these deficiencies."²³

Gunpowdermaker of the Confederacy, 13.

²²Rains, Confederate Powder Works, 11.

²³*Ibid.*, 8; Melton, "A Grand Assemblage," 30.

While traveling between different powder factories, Rains made rough drawings of the buildings along with their dimensions. He also drew sketches of the machinery required and forwarded them to Gorgas for construction at the Tredegar Iron Works. He gave the rough outlines of the buildings to C. Shaler Smith, an architect and civil engineer employed at the Tredegar Works, to complete after the selection of Augusta became final. Rains wanted to construct a systematic and efficient plant that produced large amounts of uniform gunpowder.²⁴

Construction of the Government Powder Works started in September 1861, after Rains purchased the needed materials and made construction agreements. He signed contracts for the bricks for the buildings with the Augusta and Hamburg yards. The stones needed for the foundations, lintels, copings, and sills came from Stone Mountain, Georgia, by way of the Georgia Railroad. The construction contract for the erection of the works went to Denning and Bowe of Augusta. Once the plans, contracts, and construction got underway, Rains made inspection trips to the small powder works to try to get their production up and complete the building of the Manchester Works which experienced production difficulties. He left the

²⁴Rains, Confederate Powder Works, 8, 13; Melton, "Major Military Industries," 56-58.

progress of the factory buildings in the hands of C. Shaler Smith, who took directions from Rains by mail.²⁵

Rains technological expertise served him well in drawing up the operational plans for the gunpowder plant. In late July, he advised Gorgas to order the necessary machinery immediately so that it would be completed by the time construction finished in Augusta. The powder mill required machinery for "making charcoal, refining niter, refining sulfur, breaking cake, pressing, granulating, dusting, pulverizing, glazing, &c." Rains estimated it would take the Tredegar Iron Works "working night and day . . . at least three months before any of the machinery can be put into operation." Rains also needed twenty rolling mills and predicted a lag time of four months for Tredegar to produce the necessary rolling cylinders. Added to the machinery made in Richmond, Rains purchased two small 80-horse power steam engines and one large 130-horse power steam engine in Atlanta. These steam engines proved extremely valuable to the Powder Works because they ran a sixteen foot gear box with an engine shaft that gave each building power.²⁶

²⁵Rains, Confederate Powder Works, 12; Melton, "A Grand Assemblage," 31.

²⁶Rains to Gorgas, July 25, 1861, Official Records, Ser. 4, vol. 1, 557. Rains, Confederate Powder Works, 9; Milgram, Gunpowdermaker of the Confederacy, 15.

Other purchases made by Rains during his travels included iron evaporating pans cast at an iron works on the Cumberland River in Tennessee, two hydraulic presses brought from Richmond, and large copper pans for drying the powdered saltpeter made in Nashville. The Augusta Confederate Foundry built four cast iron retorts, eight cast iron coolers, and twelve sheet iron slip cylinders. Copper boilers made from turpentine stills were purchased in Wilmington, North Carolina, and the Hights Foundry in Augusta made large steam pipes. Raw materials such as iron and coal for casting came from Alabama and northern Georgia, and the Ducktown, Tennessee, mines supplied copper until it fell into Union hands.²⁷ Thus, Rains had two major processes running simultaneously: the construction of the Powder Works and the building of machinery.

In October 1861, with construction underway in Augusta, Rains set out to solve several deficiencies. In Nashville "a special refinery for saltpetre" to help meet the South's demand neared completion and produced 1,500 pounds of refined saltpeter a day. Rains hoped to increase the total to 3,000 pounds a day. Unfortunately, a scarcity of skilled labor curtailed production. "For some days," Rains noted "every part of the operations were carried on under my personal instruction." In an attempt to solve the problem of the lack of trained laborers, Rains hired skilled labor

²⁷Rains, Confederate Powder Works, 10.

throughout the South. Instead of sending them to Augusta, where they would sit ideally until construction was completed, he sent them to the Manchester Works. The Manchester mill served as a "school of instruction for a few selected men, so as to have them ready for service" when the Augusta Works started operation. These men worked with the rolling method, mixing the ingredients under the crushing weight of cylinder barrels, the same incorporating process to be used at Augusta. Other laborers worked at the new saltpeter refinery learning how "to refine saltpetre and distill charcoal."²⁸ With this instruction, Rains provided the Ordnance Department with trained workers.

While building the Augusta works and training labor, Rains traveled to New Orleans. The city appeared to have promise as a possible major manufactory of gunpowder. In October, General Lovell reported that he had "two mills which will give us 6,000 or 8,000 pounds per day if we can get saltpeter. . . ." In November, Lovell further assured Secretary of War Benjamin that three powder mills would be in operation "in a few days . . . two of which are private property."²⁹ These forecasts, however, proved much too optimistic. On December 5, Lovell reported only two mills producing gunpowder, and one of these existed in a makeshift building of

²⁸Ibid., 5, 7; Gorgas to Rains, September 30, 1861, Rains Papers.

²⁹Lovell to Benjamin, October 25, 1861, Official Records, Ser. 1, vol. 6, 754-755; Lovell to Benjamin, November 19, 1861, Ibid., 769.

the old Marine Hospital. Rains visited these two mills and told Lovell that they should easily produce two tons of powder a day. Nevertheless, their maximum production had only been 1,500 pounds. From this point on, events disintegrated in the New Orleans Works. On December 28, 1861, 8,000 pounds of gunpowder exploded at the Marine Hospital completely destroying the mill. What was left, Lovell moved to Handsborough, Mississippi, across the river. Private contractors ran the other two mills in the city, but turned to Confederate officers, especially Rains, for supplies and technical advice. These mills, however, never met expectations and fell into Union hands with the capture of New Orleans in April 1862.³⁰

On the brighter side, the construction of the Augusta Powder Works moved along as scheduled with an adequate supply of labor and materials. The layout of the buildings allowed for systematic and efficient production; each building served a specific purpose in each phase of the powder making process with each lined up accordingly. The first building, the refinery building, sat nearest the city and served a variety of purposes. The structure fronted the canal and measured 250 feet while extending back 275 feet. Each of the corners of the building had towers serving as office space. Within the interior, the east wing provided warehouse space for supplies and had the capacity to hold 1,500 tons of saltpeter and sulfur. The west end of the

³⁰ Benjamin to Lovell, December 23, 1861, Official Records, Ser. 1, vol. 6, 786; Melton, "Major Military Industries," 54-55.

building contained a charcoal department as well as a machine shop equipped with a steam engine. "Rifle and ballistic pendulums" filled the northeast section, and a steamboiler house in the northwest portion completed the outer sections inside the building. The saltpeter refinery "occupied the right central portion" taking up approximately 3,600 square feet. In the center of the refinery building, a thirty-six square foot area "was sunk four feet to allow water from the canal to pass around the bottoms" of the large evaporating pans used in the refining of saltpeter.³¹

Gunpowder production began in the refinery building. In Rains' view, "the best quality gunpowder can only be made from the purest saltpetre." If the saltpeter proved impure or had "deliquescent salts present," the strength and uniformity of the powder would be considerably affected, causing cannon balls and minié balls to fall short or to overshoot their mark. The equipment of the refinery included two evaporating pans each with a separate furnace--the smoke passing through a flue to the huge chimney which left the refining room "entirely free from ashes, dust and smoke." With this machinery and the labors of two or three workers, saltpeter could be purified. The crude saltpeter had water added to it and evaporating pans heated it. Once this procedure took place, workers poured boiling fluid into a draining trough where the saltpeter crystals collected and

³¹Rains, Confederate Powder Works, 12-13; Milgram, Gunpowdermaker of the Confederacy, 13.

the water drained off. Once separated, these crystals went into a crystallization machine which agitated them and broke them into small particles. The final step in purifying the saltpeter consisted of removing any mother-liquor, the solution remaining after crystalization, with a thorough washing in pure water. Rains found the Augusta Canal water sufficiently pure because the district had no lime or earthy salts; therefore, it was "as nearly pure as possible."³²

The west end of the refinery building housed the area for the drying of wood for charcoal, mostly willow. As the war dragged on, willow became increasingly scarce, so the more abundant cotton wood became the primary source. After the wood dried properly, it went into the "distilling process." Iron retorts heated the wood within slip cylinders, cast iron cylinders four feet in diameter and six feet in length. Placed over furnaces, each retort remained sealed on one end and the other end had a moveable cover. Over the heat of the furnace, the open end allowed "the escape of the vapors and gases." The wood remained in the heat for two hours and formed into charcoal. Cranes pulled the hot slip cylinders containing the wood out of the retorts and placed it in cast iron coolers located below the floor in the canal water circulating through the building. This process rapidly cooled the newly formed charcoal. The cranes then dumped the charcoal on a large

³²Rains, Confederate Powder Works, 11-13; Milgram Gunpowdermaker of the Confederacy, 16-17.

table. At this point an important control process took place when workers inspected the charcoal for impurities.³³

The charcoal that passed inspection went into "pulverizing barrels with bronze balls," and these barrels revolved by a machine process crushing the sticks of charcoal into a "fine powder." Then, the saltpeter and charcoal mixed to form gunpowder. Sulfur had to be "pulverized and bolted like flour," done with the use of two twelve-inch iron wheels weighing 600 pounds each. Revolving wheels crushed the sulfur on iron beds. Carefully weighed for the proper proportions in the mixing process, the saltpeter, charcoal, and sulfur then went through a process called "mingling." The mixture made sixty-pound charges—45 pounds of saltpeter, 9 pounds of charcoal, and 6 pounds of sulfur. The next step, incorporation, by far the most dangerous, allowed the greatest possibility of an explosion and disaster.³⁴

Twelve incorporating mills extended down the canal away from the refinery building. Incorporation involved the crushing of the compounds to make gunpowder. Safety during this process remained a central concern. Rains required 1000 feet as the minimum space between the buildings. Each incorporating mill measured 296 feet long, and as Rains described "the walls

³³Rains, Confederate Powder Works, 16-17.

³⁴Rains, Confederate Powder Works, 16-17; Milgram, Gunpowdermaker of the Confederacy, 19-21.

were massive, being from four to ten feet thick, the horizontal section of each being that of a huge mortar of seventeen feet wide by twenty-four feet long; the height of the walls was twenty-eight feet." These huge walls surrounded three sides; wood and glass comprised the front of each building and the roof consisted of light sheet zinc. Thus, any explosion traveled upward and out of the front in a controlled direction. To prevent a chain-reaction of explosions, the buildings "faced alternately in opposite directions." Rains also built an automatic flooding system. In each incorporating mill, a set of 30-gallon water barrels hung above the cylinders mixing the highly volatile ingredients. An iron shaft connected these barrels in each of the buildings. In the event of an explosion in one building, the shaft would turn (from the force) in the eleven other buildings, flooding the bed plates full of unprocessed powder, thereby reducing the chance of explosion due to flying debris and sparks.³⁵

The accidents that did occur at the works in Rains' opinion "were rendered . . . by the carelessness of the powder-makers." Rules, a priority of bureaucratic control, went unobserved in these instances. Three explosions occurred at the plant during the incorporating process, and all occurred in the early months of its operation. In the first accident, a powder maker mistakenly added a new charge of powder under the incorporating rollers without removing the caked powder from an earlier process. When the

³⁵ Rains, Confederate Powder Works, 18-19.

rollers crushed these two mixtures together a fire started and produced what Rains termed "a powerful explosion." The explosion blew out the roof and front of the building but did little other damage. The other mills had their incorporating pans flooded, and only one worker suffered injuries. Rains characterized the other two explosions, where no workers were hurt, as "insignificant."³⁶

The incorporation process followed the same technique as the Waltham Abbey Powder Works in England. The three ingredients had to mesh perfectly in order to secure uniformity and accuracy as well as safety. Rains described how the process worked if observed under a microscope. "A fine particle of charcoal was seen to be a mass of carbon" he explained, "penetrated by numerous pores with the saltpetre to have the best condition." Augusta employed the rolling method process rather than the stamping method. The sixty-pound charges of saltpeter, charcoal, and sulfur, were brought to the incorporating mill from the refinery building. Workers spread it out on "horizontal cylinders of sheet copper thirty inches long by eighteen inches in diameter" that revolved around a "common axis" made out of "heavy brass tube three inches in diameter" with holes in it. Steam sent through the holes of the tube moistened and brought the compounds to a boiling point as the cylinder rotated. This reduced the

³⁶Ibid., 19-20.

material "to a semi-liquid slush." The whole process lasted eight minutes. The material then cooled and "became a damp solid cake," but at the same time, the boiling and cooling process allowed the saltpeter in the "saturated solution" to enter "the minutest pores of the charcoal," and the cake started crystalizing.³⁷

Once the material became cake-like, laborers moved it to the incorporating mills. The incorporating mill had "an iron circular flat bed of seven feet diameter," and upon this flat bed two large iron rollers weighing five tons each turned. A large cast iron shaft located underground turned the gears with 130 horse-power engine to all twelve incorporating mills. Workers placed the caked material on this flat bed, and other workers located behind the massive walls pulled the levers to lower the cylinders which crushed and rotated the bed. Rains described the incorporating process as the "crushing, grinding, mixing, and compressing" of sulfur, charcoal, and saltpeter. As the material pressed together under the weight of the cylinders, steam kept the compound moist and hot. A scraper located on one side of the bed continually broke the powder cake allowing for continuous mixture and pushed wayward scraps back under the path of the rollers. The entire process lasted an hour as the rollers revolved at ten revolutions a minute. The finished powder measured five-eighths of an inch

³⁷ Ibid., 17-18.

thick called "mill cake," and had a "blackish grey color" once it cooled. Next in the process came the granulation of this mill cake.³⁸

The granulation building, located 1,500 feet down the canal from the incorporating mills, had thin walls made of brick and a light roof. In this building, workers placed the mill cake on a turning table. "Bronze tooth cylinders" broke the cake into small pieces, and the powder, forced through different size screens, became the desired dimension and weight. Heavy grained powder served primarily for artillery usage, and the smaller powder grain for use in smaller cannons and small arms. Through his own technological ingenuity, Rains devised a way to combine the granulating process and the final process of glazing and dusting. Rains hollowed the revolving cylinders so hot air could be blown on the powder as it became granulated, joining this step with glazing and dusting "at the same time."³⁹

The worst accident occurred in the temporary granulation building. Again, Rains blamed a lack of regard for rules and regulations. The foreman, who had earned Rains' trust in safety and procedural operations, had been called away, which left no immediate supervision over the workers. At the time, the workers had no work and sat waiting for a mill cake delivery by boat from the incorporating mills. Against regulations, the

³⁸Ibid., 18, 20-21.

³⁹Ibid., 22-23.

men started to smoke, and an errant match ignited three tons of powder. "The explosion was heavy," Rains recalled, "shaking the earth for some distance, and throwing up a column of flame and white smoke five hundred feet in height." Seven men, a boy, and a mule in and around the building had been "reduced mainly to small fragments" and "the sentinel was killed by the shock." Rains pointed out, however, that because of the construction techniques, no other buildings sustained damage. And, as a compliment to Rains' safety standards, this incident remained the only accident that caused fatalities.⁴⁰

Upon completion of the gunpowder, boats carried it 1,500 feet upstream to the packaging area. In the packaging building, workers weighed and loaded the gunpowder into wood boxes two and a half feet by one foot in size. Rains found these boxes safer than barrels because of their durability, size, ease of loading, and portability. He observed that the only time this packaging exploded was an "occasional Railroad" accident. After the filling of the powder boxes, a boat transported them three-quarters of a mile up the canal to the magazine. The wood building which functioned as the magazine, had the capacity to hold 100 tons of gunpowder. Guards

⁴⁰ Ibid., 21-22; Melton, "Major Military Industries," 115; Milgram, Gunpowdermaker of the Confederacy, 33.

posted around the clock protected this valuable material from robbers and sabotage.⁴¹

Two other buildings provided power and facilities for quality control. A boiler house located 200 yards away from the granulating building produced steam power which ran through pipes to the incorporating mills. In addition, a chimney 100 yards away funneled out smoke and sparks 300 yards between the release of the smoke and the closest incorporating mill for safety. The other facility, a laboratory, located next to the refinery building, tested the powder to meet the highest standards possible. Rains examined random samples of powder for uniformity, granulation accuracy, and sufficient processing. The proper strength of the powder underwent analysis with ballistic tests. Rains employed an "electro-ballistic machine" similar to one used at the U. S. Military Academy in these examinations. Because of this type of inspection and control process, the quality of powder remained consistently high. John W. Mallet deemed the powder "the very best quality." Even the London Times, Rains noted, complimented the gunpowder. Jefferson Davis lavished praise on the works in his memoirs: "Under the well-directed skill of General Rains, we were enabled, before the close of the war, to boast of the best powder-mill in the world." After the war, the captured powder at Augusta underwent testing at the School of

⁴¹Rains, Confederate Powder Works, 22-24.

Artillery for the Boards of Artillery and Infantry Officers at Fort Monroe.

The testing rated the powder superior.⁴²

Rains completed the Government Powder Works in April 1862. In a little less than thirteen months after site selection, the mill produced gunpowder. "The winter of 1861-'2 was the darkest period of my department," Gorgas recalled, but "after the powder mills at Augusta went into operation in the fall of 1862, we had little trouble in supplying ammunition."⁴³ The daily production varied according to the demands from the field, but the mill never worked on nights or Sundays to complete workloads.⁴⁴ Gorgas reported to the Secretary of War in November 1863, that the works "kept up an adequate supply . . . notwithstanding the vast consumption and loss at Charleston, Vicksburg, and Port Hudson." Rains

⁴²Ibid., 23-25; Mallet, "Work of the Ordnance Bureau," 4; Davis, Short History, 75.

⁴³Gorgas, "Notes on the Ordnance Department," 75; Rains started making powder in the fall as soon as some of the buildings were completed, but full production did not start until the spring of 1862.

⁴⁴Rains, Confederate Powder Works, 26; "[At] the Augusta powder-mills . . . no less than 7,000 lbs. of powder are now made every day in the powder manufactory. . . . [T]he wants of the State did not render it necessary to keep these establishments open on Sundays." Freemantle, Three Months, 175-176.

observed that the only thing limiting production at all was "the amount of saltpetre on hand."⁴⁵

Complaints about the quality of powder did not, however, immediately diminish. Rains studied reports from field commanders in order to perfect his powder-making processes. Many of these complaints proved unfounded. Captain R. Jones, Commander of the Naval Foundry and Ordnance Works in Selma, Alabama, complained that the powder charges caused his cannons to splinter or fire inaccurately. Rains tested Jones' critique on the ballistic range in Augusta. In a long letter, Rains explained that the inaccuracy and the unburned powder left after a shot was not due to the composition of the powder, but to the improper amount of powder for "the weight and diminsion . . . of the projectile to be employed." If the two are not properly in balance, the gun would not fire "with the required velocity to attain its object with the greatest precission." Therefore, Rains reasoned, artillerymen needed to be very particular in the powder load added and the type of powder used. In discussions with General Beauregard, he also discovered that in the Blakely gun, an airspace should be left between the powder and the cartridge allowing "inflamed gasses" to "expand," which allowed a better burn ratio of the powder and, therefore,

⁴⁵Gorgas to Seddon, November 15, 1863, Official Records, Ser. 4, vol. 2, 957. Rains, Confederate Powder Works, 26.

greater accuracy.⁴⁶ Gorgas bluntly wrote Robert E. Lee about complaints that came from Brigadier General William E. Jones, that "officers are always ready to praise when they succeed and to blame when they fail. . . . I am quite as much inclined to blame General Jones' artillerists as he is to blame my ammunition."⁴⁷

As the quality of Rains' powder rose though, complaints dwindled. Most of the firing problems concerned artillery and involved fuses, not necessarily the powder itself. General Beauregard described the "mortar and columbiad fuses . . . [as] wretchedly bad." Gorgas' major concern with powder became stopping waste, since saltpeter remained in short supply, especially after the blockade runners became increasingly scarce in 1864 and 1865. In one particular incident, Gorgas rebuked General Beauregard's misuse of gunpowder. Gorgas disliked the fact that the Charleston Mercury reported that a twenty-one gun salute had been fired after the a victory by General Bragg. This type of waste, Gorgas feared, could cause a severe shortage in the stock of gunpowder.⁴⁸

Once the Government Powder Works started production, Rains became concerned about enemy attacks "since the loss of the works would

⁴⁶Rains to Jones, November 28, 1863, Rains Papers.

⁴⁷Gorgas to R. E. Lee, January 16, 1863, Official Records, Ser. 1, vol. 21, 748.

⁴⁸Gorgas to Cooper, October 3, 1863, Ibid., Ser. 1, vol. 28, pt. 2, 388-389.

have been followed by disastrous consequences."⁴⁹ He worried about an amphibious attack up the Savannah River, especially after the Union Army took Fort Pulaski and closed Savannah in April 1862. The Federal Navy could transverse the Savannah River inland and cause havoc in Augusta. Rains proposed a defensive position to stop this type of military assault with a set of batteries on Shell Bluff, 35 miles below Augusta, placed a hundred feet above the river.⁵⁰ Rains asked James Henry Hammond, a native of the area for an evaluation of the proposed site. Hammond found a lot of problems with the location. If a large Union force moved upriver by gunboat, "there is no Retreat," and the outcome would be a "massacre of our men." A bluff which inclined 45° behind the position blocked a rearward retreat, and on one side lay the river and the other "an impassable creek & swamp." In addition, the position could easily be flanked by an experienced commander. If a Union commander encountered the batteries, it could retreat back down the river two miles "where a fine road will enable him in an hour to put his forces on the fire plane above the Bluff, intercepting in the mean time your retreat down the River." Thus, Hammond stated concisely his conclusion that "from your position at Shell Bluff . . . there is no alternative but to conquer or die & that therefore it is no strategic

⁴⁹Rains, Confederate Powder Works, 4.

⁵⁰Rains to R. E. Lee, February 22, 1862, Official Records, Ser. 1, vol. 6, 396-397.

position at all." Instead, Hammond suggested the Augusta Bluff outside the city limits as a possible alternative.⁵¹

Rains accepted Hammond's report as sound advice. In June 1862, Rains requested from Gorgas 100 Enfield rifles to arm sharpshooters.⁵² Hammond outlined a plan to place 25 riflemen along each side of the bluff with Enfields, minié rifles, or double-barrel shotguns. These men, along with six rifled cannons and two Columbiads (8 inch) could defend the city "if they are judiciously placed."⁵³ Rains also erected earth-works around the city, and he received permission from the Secretary of War Seddon to direct a local company in its defense.⁵⁴ He cautioned Seddon that "Augusta and Chattanooga should be held at every and all hazards. They cannot be lost without the loss of Georgia, and that would be fatal to the Confederacy."⁵⁵

Despite these concerns, the largest industrial plant outside of Richmond never suffered from a large, well-planned enemy attack. Sherman chose to bypass Augusta on his march to the sea. In February 1865, Rains prepared to move the plant and equipment to Athens, Georgia,

⁵¹Hammond to Rains, May 21, 1862, Rains Papers.

⁵²Rains to Gorgas, June 7, 1862, Official Records, Ser. 1, vol. 14, 562.

⁵³Hammond to Rains, May 21, 1862, Rains Papers.

⁵⁴Rains to Seddon, August 10, 1863, Official Records, Ser. 4, vol. 2, 705.

⁵⁵Rains to Seddon, July 23, 1863, *Ibid.*, 661.

because he feared Federal cavalry attacks from the Union forces marching to Columbia.⁵⁶ Nevertheless, the call for gunpowder did not diminish. In the last month of the war, Gorgas showed the confusion of the situation when he wrote Rains: "I am looking anxiously for some news of you—I don't know where you are nor what . . . your disposition. . . . I suppose that you moved most of the powder mill to Athens." But, even without knowledge of Rains' whereabouts, Gorgas knew the system they had set up might still be running. "I trust however," he wrote, "you will soon . . . give us some musket powder. . . ." This assumption proved accurate as Rains kept the Powder Works in Augusta, and by mid-March had reassembled the equipment he had packed up and again produced powder.⁵⁷ Sherman continued north, and Augusta appeared safe. "The storm of war has swept by you," Gorgas observed, "& you will be left comparatively undisturbed."⁵⁸

The shortage of skilled labor threatened to cut the capacity of the works, especially after the draft pool expanded in 1864-1865, and fewer waivers went out to workers for deferment from service in the Confederate Army. Rains complained about a chronic shortage of labor. He queried

⁵⁶Melton, "A Grand Assemblage," 35; Ruby Mabry McCrary Pfadenhauer, "History of Augusta Arsenal in Augusta, Georgia," Richmond County History 2 (Summer 1970): 19.

⁵⁷Gorgas to Rains, March 4, 1865, Rains Papers; Pfadenhauer, "History of Augusta," 19.

⁵⁸Gorgas to Rains, March 14, 1865, Rains Papers.

Secretary of War Randolph to gauge the possibility of having "disabled men" who are skilled laborers substituted for those able to perform field duty. In addition to this request, Rains searched hospitals for men to transfer to Augusta when well enough. Gorgas empathized with Rains' plight of losing men to the army and the "cutthroat wage bargaining" for what skilled laborers remained, even between different government departments.⁵⁹ "This idiocracy," Gorgas fumed to Rains, "I am trying to impress on the minds of those in authority & by perseverance hope eventually to succeed."⁶⁰

In the end, neither a shortage of manpower, enemy raids, nor explosions stopped production of gunpowder. For three years gunpowder poured forth at a rate of as much as 5,000 pounds a day for a final output of 2,750,000 pounds.⁶¹ Perhaps General Benjamin Huger best described the contribution that George Washington Rains made to the Confederate forces when he wrote him, "your getting those works in such order has been of the

⁵⁹ General Orders No. 82, Adjutant and Inspector General's Office, October 20, 1864, Official Records, Ser. 4, vol. 3, 741. "The Chief of the Bureau of Ordnance will, without delay, take measures to place in the field one-fifth of all men employed in his department (including contractors and their employés). . . ." Melton, "A Grand Assemblage," 35; Vandiver, Ploughshares into Swords, 144.

⁶⁰ Gorgas to Rains, October 30, 1864, Rains Papers.

⁶¹ Melton, "A Grand Assemblage," 37.

greatest benefit to us, and you have been of value to us at least equal to two Generals."⁶²

The leaders of the Confederate Ordnance Department had successfully incorporated the ideas of modern industry. They maintained system, uniformity, and control. The department also used the latest technology and organized skilled labor efficiently. The implications of these bureaucratic ideas for the creation of the New South cannot be ignored. To be sure, their antecedents existed in the antebellum South. Nevertheless, the Civil War dramatically changed the mindset of many Southerners toward technology and industry. New South advocates used military defeat as justification for the growth of railroads and industry. In the process, they encouraged bureaucratic systems of control. Many of the Confederacy's bureaucratic leaders, including Gorgas, Mallet, and Rains, later espoused these ideas in academia. Indeed, many Confederate officers played a significant role in higher education reform in the postwar South. From the halls of academia, these men taught the South the lessons they had learned in the war and applied them to southern society. A New South emerged from the ideas associated with railroads, plantations, and war.

⁶²Huger to Rains, [?] 6, 1864, Rains Papers.

CHAPTER 6

ORGANIZING A NEW SOUTH

In April 1865, the South faced an uncertain future. Railroads had been destroyed during the war, plantations and farms had reverted back to swamp and weeds, and the slave labor system had been destroyed. Milton Brown, the president of the Mobile and Ohio Railroad, captured the bewilderment that many southerners felt. "As a mariner," he wrote, "who has been driven and tossed by winds and waves until hope is nearly extinguished," the South must "embrace the first moment of calm to take a reckoning of where he is, and calculate the chances of finally reaching the shore." Southerners had to come to terms with the "destructive war" and to move forward with "great enterprise."¹ The South not only had to be reconstructed, it had to be reorganized.

The South was a very different place from the one southerners had viewed just five years earlier. The 1860 census had revealed a prospering and growing region with few signs of economic stagnation. Indeed, the

¹Proceedings of the Eighteenth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Co. (Mobile, 1866), 3.

1850s had been a decade of economic expansion. Cotton had fueled the growth of railroads, steamboats, and plantations. Along with this economic expansion, new organizational ideas of system, uniformity, and bureaucratic control had emerged. Railroads led the way with modern business practices as southern railroad managers applied bureaucratic hierarchies, rules, regulations, time management, and new accounting principles. Progressive Southerners, especially Whigs, had brought modern organizational concepts to plantations and education. Railroads and plantations had helped organize the South during the antebellum period, but it was the crucible of war that intensified the organizational mentality.

The Civil War further reinforced for southerners the importance of system, uniformity, and bureaucratic control. The war destroyed slavery but not the new gospel of organization that had matured in it. In fact, it dramatically changed the mindset of many Southerners toward technology and industry. New South advocates employed military defeat to justify further growth of railroads and industry. In doing so, they encouraged the creation and growth of bureaucratic systems of control. The organizational leaders during the war, William M. Wadley, John W. Mallet, George Washington Rains, and Josiah Gorgas, taught southerners the lessons of organization, system, and uniformity that they had learned during the conflict. To create a New South, they insisted, railroads, plantations, and education needed to be reorganized. Southern railroad managers learned from their wartime failures, particularly from the fragmented system that

had hindered the war effort. As a result, they pushed for organizational change and consolidation. Agricultural reformers continued to stress the need for system, control, and scientific management on farms and plantations. A New South was about to be built on the foundation of railroads, plantations, and war.

After the war, rebuilding and re-implementing their control processes became the first priority of southern railroads. Most large railroads accomplished this task relatively quickly because their infrastructure had remained intact. The principal problem faced by railroad managers was the dilapidation of their equipment. Ditches, bridges, timber, and rails had been neglected for four years. Smaller lines, which had not been deemed essential to the war effort, suffered even more severely because their track had been ripped up for use on more important lines.

Railroad managers also needed to re-establish their bureaucratic systems of control. Most returned to the system that had served them well during the 1850s. But they also improved their operations through the addition of the telegraph, a new technology that had proved its value during the war. Moreover, many of the lines improved their accounting procedures. Southern railroads also ended the fragmented system of lines by consolidating their operations, which promoted the economic integration of the South. In the late 1860s, consolidation remained in southern hands, but as financial difficulties developed, northern capitalists asserted control over

southern lines. By 1893, when the Southern Railway Company was formed, northern capital controlled the vast majority of rail lines in the South.²

Immediately after the war southern railroads began to repair their lines and equipment. They ordered new rails from the North and Europe and repaired depots, pump houses, and bridges. William M. Wadley, fresh from wartime service of trying to organize Confederate railroads, took charge of the Central of Georgia. He reported to stockholders that Sherman's army had left the once proud and well-run railroad in "utter destruction" and "consequent prostration of its once prosperous business." The Richmond and Danville's 1866 report suggested similar problems. "From want of the necessary motive power," it conceded, "the ditches had not been cleaned out during the war, consequently in many places the mud and water covered the rails." Moreover, "a large portion of the cross-ties in the main track were decayed and rotten." The Memphis and Charleston's review of the situation was much the same. "The ditches," it reported,

²The important works that address the complex operations of southern railroads after the Civil War include John F. Stover, The Railroads of the South, 1865-1900 (Chapel Hill: University of North Carolina Press, 1955); Maury Klein, The Great Richmond Terminal: A Study in Businessmen and Business Strategy (Charlottesville: University of Virginia Press, 1970); Mark W. Summers, Railroads, Reconstruction and the Gospel of Prosperity: Aid under the Radical Republicans, 1865-1877 (Princeton: Princeton University Press, 1984); Allen W. Trelease, The North Carolina Railroad, 1849-1871, and the Modernization of North Carolina (Chapel Hill: University of North Carolina Press, 1991); Scott Reynolds Nelson, Iron Confederacies: Southern Railways, Klan Violence, and Reconstruction (Chapel Hill: University of North Carolina Press, 1999).

"were filled with earth, the embankments much weakened, and the timbers . . . required renewal."³

The repair work on southern railroads became extremely expensive. The lines had to buy new rails, locomotives, and machinery, and most found their rolling stock scattered all over the South at the end of the war. The Central, for example, had only 14 operating engines in 1866, compared to 49 in 1861. In 1866, the road procured 2,375 tons of new rail and re-rolled 1,650 tons, and bought three engines, 150 boxcars, and 75 platform cars. The Richmond and Danville had to replace 1,100 tons of rail and put in 114,958 new cross-ties. The Mobile and Ohio invested almost three million dollars in its road by 1867. For these sorts of expensive repairs, southern railroads depended on the sale of bonds, backed by mortgages on the companies, in the North and in Europe. The large debts they incurred, along with the politics of Reconstruction, opened many railroads up to northern dominance, bankruptcy, or both.⁴

³Thirty First Report. Central Rail Road and Banking Company of Georgia (Savannah, Ga., 1866), 303; Nineteenth Annual Report of the Richmond & Danville Railroad Company (Richmond, Va., 1866), 82; Twelfth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Co. (Memphis, 1866), 44.

⁴Thirty First Report. Central Rail Road and Banking Company of Georgia (Savannah, Ga., 1866), 307, 332; Nineteenth Annual Report of the Richmond & Danville Railroad Company (Richmond, 1866), 82; Proceedings of the Nineteenth Annual Meeting of the Stockholders of the Mobile & Ohio Railroad Co. (Mobile, 1867), 4; Summers, Railroads, Reconstruction, and the Gospel of Prosperity, 268-298.

Southern lines also set up repair shops to try to get as many machines as they could in working order. These undertakings meant getting machine shops up and running with system and efficiency. Southern railroads did much of their own repair. The Charlotte and South Carolina reported that it had "invested in improved machinery" that increased "the capacity for economical work." The superintendent also detailed how the line had rebuilt its machinery and its workshops. New machinery included a "hydraulic wheel press," a planer, a steam hammer, a "fan blast for the forges," a large crane, and other "necessary appliances for casting iron or brass." The company also started building a shop for car and locomotive repair.⁵

For the ditching, graveling, and rail replacement, the railroads employed the antebellum system of labor. Railroads managers organized the men in gangs at five- to ten-mile increments with a supervisor for every twenty men. The Central of Georgia immediately set up a lumber train, each with a gang of hands, to repair "timber, ties, iron and other material." At the same time, they used gravel trains to clear out ditches and fill in abutments on bridges. Recently freed slaves constituted a large percentage of the labor force. Many, in fact, did the same jobs they had performed before the war. Railroad managers hoped to maintain the system and control of

⁵Proceedings of the Stockholders of the Charlotte & South Carolina Railroad Company (Columbia, S. C., 1867), 8, 12.

labor that they had become accustomed to with slavery. Blacks worked as laborers, firemen, brakemen, or woodcutters. As before the war, now paid former slaves received room and board, while white workers, who were paid more, did not.⁶

Railroad managers complained that because of emancipation there was a shortage of labor and that blacks no longer worked as hard as they had as slaves. As a result, they believed, productivity fell. The Columbia and Augusta Railroad reported that it had great "difficulty of commanding a regular laboring force--having, as a general rule, to commence each month's operations with a new set of hands." William M. Wadley, who had gained most of his thirty years of railroad experience during the antebellum period, noted a significant difference in labor costs. He complained to stockholders that the "system of labor had . . . undergone an entire change, necessitating the employment of a much greater force than . . . under the former system." He calculated that slaves "made an average of 23 3/4 days each per month" while now black labor averaged "19 2/8 days each per month." In order to retain power over workers and to get "good hands," Wadley implemented strict guidelines. "Our practice," he explained, "is to pay them promptly for

⁶Trelease, The North Carolina Railroad, 220-222, 233; Thirty First Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1866), 327.

their labor, and to discharge them as soon as they become disobedient or are found to be unfaithful."⁷

Nevertheless, control of labor became much more difficult after the war as railroad workers, both black and white, became more assertive in the post-emancipation South. In 1868, L. J. Fleming, the superintendent of the Mobile and Ohio, told stockholders that mechanics at the Jackson shops had gone on strike and kept trains from moving for a week. "In this strike," he reported, "there was no personal violence attempted; but by threats of secret violence they intimidated those who were otherwise disposed to run the trains." The Memphis and Charleston Railroad, on the other hand, tried to acquire "cheap, steady and uniform labor" by improving living conditions. The company built "comfortable cottages and cabins" along its lines to encourage workers to stay. The managers found that the improved housing did attract a "good class of laborers with families." Other railroads took a different approach and began to employ convict labor. A Georgia state investigation found that some railroad contractors brutally enforced discipline and whipped nude convicts for infractions. As the use of convict labor expanded, it undermined the power of unskilled railroad laborers in

⁷Trelease, The North Carolina Railroad, 220-222; Report of the Proceedings of the Stockholders of the Columbia and Augusta R. R. Company (Augusta, Ga., 1866), 8; Thirty First Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1866), 326.

the South. One of the ironies of the New South was that modernization came on the back of convict labor.⁸

Within a year of the war's end, most southern lines had portions of their road operating. Most roads used the bureaucratic structure developed in the 1850s—a departmental structure for transportation, way, machinery, and road departments, each with a hierarchy of command. William Wadley organized the Central with the same departments as before the war, transportation, road, machinery, and used the same hierarchy for management and control. Sam Tate, of the Memphis and Charleston, also maintained the same bureaucratic structure.⁹ While the lines retained the bureaucratic structures developed by the 1850s, most updated their accounting procedures. In 1867, the Memphis and Charleston outlined its guidelines. It broke down its statement into eight parts. The superintendent of the Charlotte, Columbia, and Augusta Railroad proclaimed that its accounting had to be "managed with skill and ability" because of a railroad's

⁸Proceedings of the Twentieth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad (Mobile, 1868), 18; Sixteenth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Company (Memphis, 1870), 29-30; Nelson, Iron Confederacies, 78-79; For an excellent overview of convict leasing in the South, see Alex Lichtenstein, Twice the Work of Free Labor: The Political Economy of Convict Labor in the New South (New York: Verso Press, 1996).

⁹Trelease, The North Carolina Railroad, 230-235; Thirty First Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1866), 314-345; Twelfth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Co. (Memphis, 1866), 48.

"complicated and extensive duties." This railroad supplied no fewer than twenty-seven pages of accounting information in its annual report to stockholders.¹⁰

Southern railroads also embraced new technology. The Mobile and Ohio and the Central of Georgia both adopted the Westinghouse Airbrake in the 1870s, and most lines started replacing iron for steel track. The increased use of the telegraph improved system and control substantially by improving precision, making accidents less likely, and making the synchronization of trains easier. The Southern Express Company, the Southern and Atlantic Telegraph Company, and Western Union provided telegraph services to southern lines.¹¹ The Mobile and Ohio Railroad, for example, made an agreement with Western Union for an independent telegraph wire to give the railroad exclusive use. The railroad president told stockholders that the telegraph would "reduce the cost of operating the road by adding to the facility and consequent economy in the movement of trains." In 1873, L. J. Fleming, the road's superintendent, explained the

¹⁰Thirteenth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Co. (Memphis, 1867), 33; Proceedings of the Stockholders of the Charlotte, Columbia & Augusta Railroad Company at their Second Annual Meeting (Columbia, S. C., 1871), 19, 27-47.

¹¹Proceedings of the Twenty-Fifth Annual Meeting of the Stockholders of the Mobile and Ohio R. R. Co. (Mobile, 1873), 19-20; Forty-Third Report of the President and Directors of the Central Rail Road & Banking Company (Savannah, Ga., 1878), 14; Trelease, The North Carolina Railroad, 73, 237.

telegraph's virtues as a management tool. He observed that the telegraph had become "very valuable for the distribution of cars to meet unexpected demands . . . and in case of accidents, for the concentration of labor and materials for the necessary repairs." The next year, Fleming organized the line into five freight divisions controlled by telegraph communication. The telegraph, he reported, had "enabled [trains] to make nearly double ordinary schedule speed, without running objectionably fast." "This system," he continued, "has proved a very great success in an economical point of view . . . and given additional satisfaction to the public, combining as it does, safety and speed." The telegraph, along with improved time-keeping and elaborate rules, became vital to maintaining system, uniformity, and control on southern railroads.¹²

The war also taught railroad managers important lessons concerning logistics. The unloading and reloading of freight every time it moved from one railroad line to another was grossly inefficient and caused delays, damaged goods, and endless difficulties. To end that practice they adopted an innovation called "through freight," which allowed freight to move from one line to another on the same car. To work, through freight

¹²Proceedings of the Twenty-Third Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Co. (Mobile, 1871), 4; Proceedings of the Twenty-Fifth Annual Meeting of the Stockholders of the Mobile and Ohio R. R. Co. (Mobile, 1873), 19; Proceedings of the Twenty-Sixth Annual Meeting of the Stockholders of the Mobile and Ohio R. R. Co. (Mobile, 1874), 10.

required the cooperation of several connecting lines and accurate booking. This new arrangement required an expansion of clerical staffs to maintain a clear picture of the location of freight and cars. The results justified the change as the interstate through system increased speed, accuracy, and efficiency.¹³

By allowing full freight cars to transfer from one railroad line to another, freight could be shipped long distances without being unloaded and reloaded. Each railroad repaired its own cars. When a car traveled on another road, that railroad charged a fee for the use of its track and facilities. The rental fee for the North Carolina Railroad, for example, was two-and-a-half cents per mile. Thus, the through freight system enabled southern railroads to overcome logistical problems that had plagued antebellum railroads. The Mobile and Ohio noted in 1866 that "through rates of freight will be made with all connecting roads . . . and through bills of lading will be given for delivery of freight at all stations on the road." The Master of Transportation for the Central of Georgia told stockholders that "through rates have been made to every accessible station in the interior for freight, and to all the most prominent points of passage."¹⁴

¹³Trelease, The North Carolina Railroad, 236; Klein, The Great Richmond Terminal, 20-21; Nelson, Iron Confederacies, 51-54.

¹⁴Trelease, The North Carolina Railroad, 236; Proceedings of the Eighteenth Annual Meeting of the Stockholders of the Mobile and Ohio Railroad Co. (Mobile, 1866), 23-24; Thirty First Report. Central Railroad and Banking Company of Georgia (Savannah, Ga., 1866), 316.

Sam Tate, superintendent of the Memphis and Charleston, explained to stockholders that through freight also helped achieve economies of scale. "The question of profits on railroads," he wrote, "depends more on the extent of business than the price you get for it." He asserted that "when you are so situated that you can run full loaded trains both ways, it can be done at much less cost and with greater profit to the Company." Tate thought that "running a day and night through freight train" would reduce "the cost of freight to about one-half or two-thirds of its present cost." He also believed that many southern railroads were "anxious to cooperate" in building connections and through-freight services. De Bow's Review also praised the efficiency of the new system. "Through freights," it maintained, can move goods "cheaper than any other, and will make fast and sure freights for the public."¹⁵

Similarly, the through bill of lading unified southern states. The uniform through bill replaced each railroad's paper work with one shipment order. This consolidation cut down on paper work, simplified shipment, and allowed the through system to work efficiently. It also allowed for the fast freight shipment of goods. Southern railroad men brought order to southern railroads in 1866 and 1867 by creating what they called fast speed Air Line services. The first important link was the Seaboard

¹⁵Thirteenth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Co. (Memphis, 1867), 13-15; "Illinois Central Railroad," De Bow's Review 5 (April 1868): 446.

Inland Air Line that ran on several lines through pooling agreements and the use of through freight. This system represented a fundamental shift in the management of southern railroads. Before the war, superintendents controlled their traffic and railroad trade. After the war, a more centralized financial structure took the movement of freight out of the hands of superintendents and placed the control of traffic it into hands of a new class of railroad financiers. These financiers managed the flow of traffic with the through bill of lading, consolidation, pooling, and holding companies.¹⁶

Two Confederate veterans, Alexander Andrews and Moncure Robinson, learned the lesson of war well. They began to consolidate control of railroads by means of a new organizational innovation--the holding company. With the Raleigh and Gaston Railroad as their base of operations, Andrews and Robinson purchased steamship companies and connecting railroads. They also made agreements with other lines. It did not hurt that Andrews married the daughter of William Johnson, the president of the Charlotte & South Carolina Railroad and the Columbia & Augusta Railroad. These two railroads merged in 1868. By using through bills of lading, Andrews and Robinson consolidated their control of trade with the fast-freight, the Seaboard Inland Air Line, that serviced 500 miles of track.¹⁷

¹⁶Klein, The Great Richmond Terminal, 20-25; Nelson, Iron Confederacies, 53.

¹⁷Nelson, Iron Confederacies, 53-55; Report of the Proceedings of the Stockholders of the Columbia and Augusta Railroad Company at their

The Charlotte, Columbia & Augusta Railroad's 1871 annual report spelled out how the system worked. "Since the great destruction of the resources of the country by the late war," William Johnson wrote, "it was seen that this would scarcely maintain it in efficient operation, and from necessity, it had to extend its terminus to a point whence it could, form more important through connections." This new system, Johnson explained, was "entirely distinct from local rates, and are the results of agreements made with all the intermediate roads to and from given points." Moreover, he continued, "the rates are made to centres of trade and points of competition by express contract, that cars may be loaded both ways and not returned empty."¹⁸

Andrews, Robinson, and Johnson learned this organizational innovation from the wartime experience of railroads. Near the end of the war, the Confederacy had established the Southern Transportation Company to ship goods from Alabama to Virginia with one bill of lading. The Seaboard Airline adopted this practice after the war. It tied independent companies together by the through bill of lading, and thereby increased uniformity and control as goods moved under a single contract across diverse lines. Agents for the Seaboard Inland ensured that freight continued

Annual Convention (Columbia, S. C., 1868), 4.

¹⁸Proceedings of the Stockholders of the Charlotte, Columbia & Augusta Railroad Company, at their Second Annual Meeting (Columbia, S. C., 1871), 7-8.

to move at the major entrepôts. The agents employed the telegraph to control the movement of freight from place to place and line to line. Thus, the Seaboard Inland became an important interregional organization.¹⁹

Andrews and Robinson envisioned further consolidation of railroad traffic. Their plans were impeded, however, when Tom Scott and J. Edgar Thomson of the Pennsylvania Railroad attempted to gain command of southern railroads. Scott sought control of southern lines from Georgia to Virginia. He intended to build a national railway system. After the war, Scott purchased several southern railroads and created a holding company called the Southern Railway Security Company. By 1870, he controlled the Richmond & Danville Railroad, but he placed Richmond natives in positions of authority. From there he moved further south. In his efforts to consolidate southern lines, he used national banks and appointed local men as railroad directors. He gained control of the important Memphis and Charleston Railroad by 1869. That line reported to stockholders that "our through freight arrangements with Eastern cities via Norfolk, with fast Through Schedule east and west, is operating vary [sic] satisfactory, with the exception that the rates are very low--the result of competition." In 1872, Scott started building the Atlanta & Richmond Airline from Charlotte to

¹⁹Nelson, Iron Confederacies, 58-62.

Atlanta. By 1873, the Southern Railway Security Company operated 2,131 miles of track and 13 separate lines from Georgia to Virginia.²⁰

Other southern railroads outside of Scott's control also consolidated. As one historian has described the movement for consolidation, it "was almost an obsession among Southern railroad executives, as it was among Northerners, and a dangerous fascination at that."²¹ De Bow's Review encouraged concentration. "The economy of consolidation," it asserted, "is very obvious." The writer argued that consolidation allowed rolling stock to be worked more efficiently and allowed economies of scale because "machine shops can be on a larger and more complete scale." Moreover, "the cost of officers will be greatly reduced, when a single directory will control one thousand miles of road, instead of committing the same business to ten separate administrations." The Pennsylvania Railroad proved the truth of this assertion by "running a distance of about 850 miles."²²

²⁰Fifteenth Annual Report of the Board of Directors to the Stockholders of the Memphis and Charleston Railroad Company (Memphis, 1869), 16; Summers, Railroads, Reconstruction, and the Gospel of Prosperity, 177; John F. Stover, "Southern Railway," in Robert L. Frey, ed., Encyclopedia of American Business History and Biography: Railroads in the Nineteenth Century (New York: Facts on File, 1988), 373; Stover, Railroads of the South, 99-103.

²¹Summers, Railroads, Reconstruction, and the Gospel of Prosperity, 180.

²²"Railroad Policy for the South," De Bow's Review 5 (July 1868): 610.

William Wadley realized that the Central of Georgia had to expand if it wanted to compete with the Southern Railway Security Company. The Central's 1872 annual report asserted that "with the numerous lines of transportation from New York to the South and South-west . . . it became important for us to have control" of other lines and steamboats "in order . . . to perfect our line." Wadley began acquiring lines in Alabama and Florida. He bought or leased the Southwestern, Macon and Western, Griffin & North Alabama, Western Railroad of Alabama, and the Montgomery & West Point. Similarly, H. S. McComb worked closely with the Illinois Central to gain control of the Mississippi Central and trade with New Orleans and the Great Lakes.²³

When the Panic of 1873 struck, consolidation of southern railroads was well under way. The economy's collapse, however, revealed the financial weaknesses of southern railroads. Most remained heavily in debt and had overextended themselves by construction, much of which had been spurred on by the Republicans' overzealous policies for railroad financing at the state level. At the same time, southern railroads struggled with competition and low freight rates. Scott and the Pennsylvania, because of severe financial problems, pulled much of their assets out of the South after

²³Thirty-Seventh Report of the President and Directors of the Central Railroad and Banking Co. of Georgia (Savannah, Ga., 1872), 16; Klein, The Great Richmond Terminal, 80-81; Summers, Railroads, Reconstruction, and the Gospel of Prosperity, 177.

the Panic. The fall of the Southern Railway Security Company left a void in the southern railroad system. Moreover, cut-throat competition and low freight rates threatened those roads that had not fallen into receivership. In the face of bankruptcy, consolidation became a means of survival as southern railroads tried to bring order out of the chaotic business climate.²⁴

Wadley and the Central railroad tried to rationalize a confusing and dangerous business environment by creating a pooling system in 1875. The organization, called the Southern Railway & Steamship Association, attempted to stabilize transportation rates. Wadley wrote that that he was "anxious for the success of the Association." The pooling agreements, however, did not bring about the results for which railroad managers had hoped. Railroad rates continued to fall, as did profits, and more roads fell into receivership. As a result, consolidation accelerated in the late 1870s. The Illinois Central took over the Mississippi Central in 1877. From 1878 to 1881, the Louisville and Nashville went from 966 miles to 3,231, the East Tennessee from 272 to 1,389 miles, and the Central of Georgia from 861 to 1,754 miles. Northern capitalists played a significant role in this consolidation. Thus, the South, like the rest of the nation, experienced the

²⁴Summers, Railroads, Reconstruction, and the Gospel of Prosperity, 185, 269-298; Stover, "Southern Railway," 372-373; Klein, The Great Richmond Terminal, 21-23.

emergence of a new organizational age dominated by pools, trusts, and holding companies.²⁵

The introduction of through freight, the telegraph, and consolidation caused dramatic changes in southern trade patterns. New Orleans, Mobile, Charleston, and Savannah no longer lay at the heart of the cotton trade. The railroads and the emergence of through freight system shifted the trade through the New South cities of Atlanta, Charlotte, and Nashville. Goods now flowed North and into the national system. At the same time, this shift in trade undermined the domination of the cotton merchant system. The telegraph enabled buyers to determine prices without going through a middleman. System, uniformity, and organization became the way of business in the New South. By aiding the growth of industries such as textiles, tobacco, mining, iron and steel, and timber, southern railroads also contributed greatly to the growth of the New South.²⁶

²⁵Forty-First Report of the President and Directors of the Central Rail Road and Banking Company of Georgia (Savannah, Ga., 1876), 6; Proceedings of the Convention of the Southern Railway and Steamship Association (Atlanta, Ga., 1875). Albert Fink Papers, Box 1, Folder: Printed Matter: Reports of the R. R. Proceedings & Conventions, Library of Congress, Manuscript Department, Washington, D. C.; E. Dale Odom, "Albert Fink," Railroads in the Nineteenth Century, 121; Summers, Railroads, Reconstruction, and the Gospel of Prosperity, 177, 277; Klein, The Great Richmond Terminal, 24.

²⁶Nelson, Iron Confederacies, 80-83.

The destruction of the railroads during the war was accompanied by the destruction of the plantation system. Plantations, farms, and the labor system now had to be rebuilt on a new economic, political, and social foundation. The idea of a New South based on system, uniformity, and bureaucratic control emerged immediately in the form of calls for education, technology, industry, and agricultural reform. In 1867, a revived De Bow's Review, the voice of the progressive antebellum South, forecast a New South based on railroads, industry, and diversified agriculture. In fact, the journal gave the impression that the Civil War had freed the South to grasp new organizational ideas and embrace economic change. "A radical change," the writer declared, "has been wrought in our labor system." In response, the South needed to turn its attention to new pursuits. Southerners should study the methods used in cotton factories and apply them to southern society. Moreover, the writer stated, "it is highly important to the success of popular education, that there be systematic employment and associations." According to De Bow's, the outlines of a New South were already visible.²⁷

More practically, however, the first priority of white southerners became the task of rebuilding the agricultural system. As Gavin Wright demonstrated in his work, with the destruction of slavery, southern

²⁷"The New Era of Southern Manufactures," De Bow's Review 3 (January 1867): 57,65.

planters, once "labor lords," had become "land lords."²⁸ Nevertheless, cotton remained a labor intensive crop and southern planters and farmers still needed their workforce. To accomplish this task, they used the system, organization, and control developed during the antebellum period in their approach to managing labor. In the planters' view, system and control had become even more essential after the war because laborers had more freedom and received compensation for their work. As John W. Mallet, the head of the Confederate Ordnance Laboratory and a chemistry professor at the University of Virginia after the war, told farmers in an agricultural address, free-labor demanded "economy of time, economy of labor, economy of money." Southern planters hardly had to be convinced. They had already begun to apply the antebellum system and organization of production in their quest to control free labor. White planters and farmers held racist assumptions that blacks would not work efficiently without stern and proper organization and discipline. As one historian has argued, planters and farmers wanted a "firm, disciplined, and regular system of plantation management" that would "compel black people to work regularly."²⁹

²⁸Gavin Wright, Old South, New South: Revolutions in the Southern Economy Since the Civil War (New York: Basic Books, 1986), 17-50.

²⁹"Address of Prof. J. W. Mallet, Delivered at the Augusta County Fair," Southern Planter and Farmer 30 (November 1869): 727; Mark M. Smith, Mastered by the Clock: Time, Slavery, and Freedom in the American

Southern planters and farmers understood that a regular system meant rules, regulations, and proper accounting procedures. "Order and system," a Georgia farmer wrote, "are as important to success in farming as any other business." Free labor, southern agricultural journals argued, did not mean unruly, uncontrolled, and inefficient labor. Southern farmers needed to assert their power over free black labor in the same way northern factories and railroads controlled their workers—through bureaucratic control, rigid rules, and the application of a modern conception of time. These journals printed rules as guidelines for the proper organization of labor. Their rules mirrored those that had guided antebellum management of plantations. One perceptive planter observed in 1887: "Whatever improvements we of to-day have made upon the methods of ante-bellum days is due more to the growth of the ideas of our predecessors than to our own boasted probity and enterprise." He found "most of our wisdom is inherited."³⁰

That the labor rules in the New South followed those of the antebellum South may be seen in the list of rules published by the Southern Planter. On a large farm, the journal stipulated, "it is of the utmost consequence to have hands especially appropriated for each of the most

South (Chapel Hill: The University of North Carolina Press, 155.

³⁰"System in Farming," The Southern Farm and Home 4 (February 1873): 128; Quoted in Smith, Mastered by the Clock, 158.

important departments of labor." A farm manager should guard against a "loss of time" and "work . . . not executed." To accomplish the goal of efficiency, farmers and planters needed to inspect all operations "regularly" and arrange workers, animals, and tools so as "to diminish labor or increase its power." Moreover, the writer believed that every well-managed farm demanded proper accounting to ensure "practical management."³¹

Southern agricultural journals also stressed the importance of time management and the need to run farms and plantations like a factory. As in the antebellum period, agricultural reformers remained enamored with system, efficiency, and technology. "Labor is money or its equivalent," noted a contributor to the Southern Planter and Farmer, and it "should be so considered on the farm as well as in the workshops." Consequently, if an hour of labor was lost, "it should be counted at its value." This modern conception tied time and productivity together.³²

In a similar essay, entitled "Labor," published in The Plantation, A. E. Cox promoted system and control on farms and plantations. To get the most from a laborer, a supervisor should "systematize his work" and give "attention to every department of his farm." Control of time became critical in a free-labor system. "One of the hardest things to do," he maintained, "is

³¹"Rules for Farmers," Southern Planter 29 (March 1868): 164.

³²"Save Your Labor," Southern Planter and Farmer 34 (January 1873): 13-14.

to bring the negro to time." Therefore, a planter should "let every one know that his time is being kept. . . . Impress every laborer with the conviction that no lost time can be regained." This control required strict guidance from the manager. Another contributor added that "it will not be denied that system is the basis of success in all departments of industry." He believed that "without system, the cotton planter is a mere gambler." To develop such a system, he suggested that southern farmers study northern farmers because they were superior "in the matter of systematic farm economy."³³

Other reformers agreed. Francis Fontaine, a Cartersville, Georgia, farmer, saw the connection between northern factories and railroad organization, discipline, and time management. He calculated "if a hand loses one half hour each day in a year he will lose 150 hours or nearly half a month's labor." He further observed that factories and railroads did not tolerate lost time. "Probably not a planter or farmer in Georgia charges for time lost. Yet factories, railroads, mills . . . charge one quarter of a day, if a hand losses 15 minutes." Fontaine found, however, that many cotton planters ignored the idea of time management, noting that, "scarcely any industry could long maintain itself, if this one item, lost time, were as

³³"Labor," The Plantation: A Weekly Devoted to Agriculture, Manufactures and all Industrial Pursuits 3 (March 27, 1872): 194; "The South Must Reorganize and Develop Her Own System of Agriculture," The Plantation: A Magazine of Progressive Agriculture and Improved Industry 3 (December 1872): 56.

practically ignored, as cotton planters as a rule do ignore it." Fontaine encouraged southern farmers to emulate northern factories. If they did, he concluded, southern farms could run with the "system and discipline of labor in a Northern factory."³⁴

A more radical conception of agricultural labor was that of a South Carolina author who suggested that manual labor should be viewed as a "machine." "You can count with great certainty what your steam engine will do, and what it will cost to run it," he wrote. A planter should try to get the same type of regularity from his laborers. However, because a workforce was a "more complicated machine," it required an "accurate governor to regulate its movements." The governor, of course, was the manager. The farmer who did not work labor diligently and efficiently "pursues a policy suicidal to himself." Indeed, "he is a foe of the social order, as he violates . . . the fundamental rules . . . for discipline."³⁵ In a similar vein, a farmer from Camden, South Carolina, wrote that "the hired labor may justly be regarded as a 'machine' whose efficiency will depend upon the skill and diligence of the 'engineer' (employing capitalist) who runs it." If the "machine" did not work effectively the "engineer" could be blamed for not determining the proper order and for not using his labor "advantageously" as a "machine."

³⁴Francis Fontaine, "Georgia Agriculture--Plantation Economy--Facts and Their Answers," Southern Cultivator 29 (September 1871): 324-326.

³⁵"Labor and Capital," Southern Cultivator 29 (July 1871): 252-253.

For "machines" to run well, the writer asserted, work needed to be selected "judiciously," well-managed, and properly organized. If this were done, the "machine" would run "at its highest capacity."³⁶

The Southern Planter and Farmer reprinted an article from the northern American Farmer that tied system, order, and efficiency to economical management. To have "proper economy," the writer averred, "the practical farmer should maintain order, system, and discipline on the farm." This economy could only be achieved with proper planning, organization, and time management. Everything needs to run like clockwork, he wrote, otherwise, "when a farmer gets behind on his work, one operation begins to crowd upon another, confusion and embarrassment ensue" often "involving the loss of much time and labor." He further noted that much time would be saved by the "proper location of buildings, farm-pens, and roads of the farm." Much like a factory, a farm required an efficient layout so that time was not wasted "hauling and passing from one end of the farm to the other." Moreover, because tools should be centrally located and protected, "the master should see to it that the laborers lodge them whenever they stop using them."³⁷

³⁶"Criticisms of July Number," Southern Cultivator 29 (August 1871): 293.

³⁷"Economy," Southern Planter and Farmer 36 (August 1875): 401-402.

The organizational ideas to which former Confederates had been exposed during the war also influenced their conception of management. A Confederate veteran called for system and discipline when it came to dealing with labor. "I have acted in a subordinate position myself, under the authority of military superiors," he wrote. To control one hundred men, he explained, took "a firm disciplinarian." A speaker at one Georgia State Agricultural meeting believed that running a farm or a plantation paralleled leading an army. "Our ideal farmer," he wrote, "must possess in an eminent degree, what is best expressed by the term executive ability." He believed that laborers should have the same respect for supervisors that soldiers had for "Lee and Jackson." Accordingly, a farmer "must be a great general, with power to systematize, to organize and to make every instrumentality at his command co-operate harmoniously in producing any desired result." To accomplish this system, a farmer had to follow "scientific principles" and "embrace . . . the applications of those principles."³⁸

Proper accounting was the key to saving time and money. A farmer from Granville, North Carolina, wrote the editor of the Southern Planter that the war had changed everything. Before the war "experience was teaching us, slowly but surely" that "bookkeeping" was important. The war

³⁸"Treatment of Laborers," Southern Cultivator 25 (February 1867): 42; Transactions of the Georgia State Agricultural Society. From August 1876. to February, 1878 (Atlanta: James P. Harrison & Co., Printers and Publishers, 1878), 237.

and the employment of free labor now was teaching "us . . . rapidly and fatally, that with the costly labor of freed men . . . the same system . . . will indeed hasten us to want and ruin." Southern farmers and planters now had to control labor costs strictly. When it came to accounting, he maintained "we must change our tactics." That meant keeping "strict, and fair, and full, and accurate account[s]." Moreover, a farmer should search for all profits and losses. From this information he could decide on the proper "systems" of crops, manures, and labor. The only way for farmers to survive in the new market was to have a "systematic method of keeping farm accounts." Another correspondent to the Southern Planter agreed. He pointed out that all businessmen, except farmers, understood "the advantages of 'keeping accounts.'" Farmers had to learn from the merchant, mechanic, and professional men the importance of maintaining control with accounting.³⁹

A North Carolina contributor suggested that farmers measure all expenses in the same way manufacturers and railroads did. Farmers and planters should keep strict account of all provisions, implements, stock, buildings, seed, manure, taxes, and wages paid. Samuel Barnett of Georgia concurred. With the end of slavery and the "gang system," careful maintenance of plantation accounts became critical to success. Farmers and

³⁹"Farm Accounts--Again," Southern Planter 29 (1868): 36; "Farm Accounts--How to Keep Them," Southern Planter and Farmer 29 (April 1868): 208-209.

planters should always be asking themselves, "What does it cost me, including, food and extras? Does it pay?" Proper bookkeeping provided the only way to answer these questions accurately. Barnett also offered an example of tabular plantation accounts of receipts and expenses, and he explained how to balance books. Another editorial writer added that farmers should account for inventory the way that manufacturers did. Farmers needed to find and record the value of everything on their farm, including "the smallest implement."⁴⁰

Along with proper accounting, agricultural reformers called for the use of labor-saving machinery and stressed that machinery replaced labor and improved productivity. "This is the age of improvement," wrote one, "especially in the reduction in the cost of labor-saving implements." Editors of agricultural journals understood that progress in agriculture depended on technological progress. The Southern Planter reprinted an article from the American Agriculturist that "labor-saving implements" reduced costs, increased efficiency, and led to more "thorough systems of farming." Another writer added that despite the "laborious operations on the farm," that "ingenious machines" could replace "brute force" in completing them. More and more, he wrote, farming relied on "man's intelligence."

⁴⁰"Plantation Accounts," Southern Cultivator 30 (January 1872): 10-15; "Plantation Accounts," Southern Farm and Home 3 (January 1872): 86; "Plantation Accounts," Southern Farm and Home 2 (May 1871): 250; "Agricultural Accounts," Southern Farm and Home 3 (July 1872): 324.

Moreover, he asserted, "machinery" had become the "great emancipator" because it brought "progress" to both "agriculture and manufactures."⁴¹

Similarly, a former Confederate officer, Captain J. N. Montgomery of Georgia, made a speech to the Georgia Agricultural Society, in which he encouraged the use of labor-saving machinery. Steam power, new plows, and new machinery, he realized, would decrease labor costs and increase a farm's efficiency. Steam power ran machinery, created power, and allowed a farm to be more "easily managed." Another speaker addressed the same group and made the same argument. "If Mechanics have indifferent tools," he noted, "it adds to his labor, consumes more time, and his work must be indifferently done. And so with the Farmer." If a farmer did not invest and use proper implements, he lost time and money. A farm required "tools adapted to it, as much so the Mechanic requires for his work." Modern manufacturing, he continued, now allowed farmers in the preparation and cultivation of the soil to economize labor.⁴² A former Confederate General, W. M. Browne, summed up many agricultural reformers' ideals in an 1870 speech to the Agricultural fair in Rome, Georgia. To run a farm efficiently and profitably, a farmer had to have "administrative ability in the

⁴¹"Improved Farming Implements," Southern Cultivator 36 (January 1878): 15; "Labor-Saving Implements," Southern Planter and Farmer 30 (January 1869): 50; "Letters from a Country Gentleman," Southern Cultivator 29 (March 1871): 91.

⁴²Transactions of the Georgia Agricultural Society, 246; "Agricultural Interests and Implements," The Plantation 3 (April 17, 1872): 242.

management and direction of the business." This administration was achieved by implementing "the proper order, system, discipline and economy" to the farm or plantation. The only way this goal could be reached, he argued, was through agricultural education, "book-farming," labor-saving machinery, and agricultural organizations.⁴³

Southern reformers also believed that education could help bring about modernization and economic growth. After the war, agricultural reformers revived the antebellum call for agricultural education and agricultural colleges. In the matter of educational reform, the lessons derived from the antebellum period and from the war converged. Before the war, progressive southerners had called for colleges to teach engineering and agricultural science. During the war, the South had depended on "soldier technologists" to build industry from the ground up. The war had required men who understood factory management, railroads, and logistics. In other words, the "control revolution" demanded an understanding of the modern principles of system, uniformity, and bureaucratic control. Former Confederate officers, who had this understanding, played an important role in transforming southern education after the war. At the college level, significant curriculum changes were introduced that stressed engineering,

⁴³"Gen. W. M. Browne's Speech at Rome," Southern Farm and Home 2 (December 1870): 47.

technology, and agricultural science. Organizational ideas developed in the crucible of war helped create a new university and a New South.⁴⁴

The ideas associated with railroad management, plantation management, and the war effort came together in post-war educational reform. In an 1868 lecture at the University of Virginia, Mallet made it clear that a modern South depended on technical and scientific education. He reflected on the dramatic changes brought about by the introduction of the railroad, the telegraph, and "the weapons of war." The steam engine, he observed, now substituted for "untold millions of men and other animals." Thus, Mallet argued, a university must educate its students "in the principles and application of natural science." In speeches to agricultural associations throughout Virginia, he highlighted the need for scientific agriculture, insisting that "in the present condition of Virginia—just beginning . . . to recover from the wounds inflicted by war," farmers and laborers must be "more skillful, more intelligent, and more economically directed."⁴⁵

Mallet became a major spokesman for scientific agriculture and agricultural education through numerous speeches and journal articles. In

⁴⁴See especially, Dan R. Frost, "A Confederate Education in the New South: Southern Academia and the Idea of Progress in the Nineteenth Century" (Ph.D. diss., Louisiana State University, 1994), 140-200.

⁴⁵J. W. Mallet, Chemistry Applied to the Arts: A Lecture Delivered before the University of Virginia. May 30, 1868 (Lynchburg, Va., 1868), 6.

a lecture reprinted in the Southern Planter and Farmer, he noted that "practical farmers" should perform scientific experiments on their farms and carefully measure everything from manure to crop yields. In another essay, he cautioned against using the "imperfect . . . 'rule of thumb'" in crop cultivation. Farmers "must examine closely the conditions necessary to make every acre of ground produce, not only a crop, but the largest crop and the best crop which can possibly be obtained from it; and this with the least possible expenditure of labor and money."⁴⁶

Mallet's belief in technical and scientific education received support from agricultural reformers. Reformers related economic progress to educational reform. A letter to the editor of the Southern Cultivator observed that the war had "opened upon a new era in everything--The very foundations of the old society have been broken up." Consequently, the writer continued, "we must begin de nova to educate our people for the new order of things. We need a new system of education--new textbooks and a new order of teachers." Much of the post-war reform rhetoric mirrored pre-war pronouncements. But in the post-war years, colleges actually changed their curricula to stress science, engineering, and technology. Men who had helped organize the South for war led this assault.⁴⁷

⁴⁶"Professor Mallet's Lecture," Southern Planter and Farmer 30 (April 1869): 227; J. W. Mallet, "Chemical Researches into the Composition of Tobacco," Southern Planter and Farmer 30 (February 1869): 119-120.

⁴⁷Southern Cultivator 33 (June 1875): 225; Frost, "Confederate

Many of the Confederate "soldier-technologists" joined the faculties of southern universities after the war. John W. Mallet, Josiah Gorgas, George Washington Rains, and William Leroy Broun, taught a new generation of southerners. From college lecterns, in articles, and in speeches, they applied their expertise to the transformation higher education. Under their direction, southern educators changed southern education by introducing scientific courses, especially chemistry and engineering, to prepare students for careers in agriculture, mining, textiles, railroad management, and other professions. If the South hoped for economic progress, Confederate veterans insisted it had to embrace the virtues of science, system, uniformity, and bureaucratic control.⁴⁸

Indeed, the success of the Confederate Ordnance Department during the war gave credence to the opinions of the men who had organized and run it. De Bow's Review, a major advocate of educational reform in the antebellum South, reported in 1868 that the teaching of "applied science" by

Education," 202-213.

⁴⁸Frost, "Confederate Education," 156; In a similar vein, see Dan R. Frost and Kou K. Nelson, The LSU College of Engineering: Origins and Establishment, 1860-1908, vol. 1 (Baton Rouge: Louisiana State University Press, 1995), and Robert J. Norrell, A Promising Field: Engineering at Alabama, 1837-1987 (Tuscaloosa: University of Alabama Press, 1990). One of Mallet's students, William Carter Stubbs, played a significant role in the modernization of the Louisiana sugar industry after the war; see, John Alfred Heitmann, The Modernization of the Louisiana Sugar Industry, 1830-1910 (Baton Rouge: Louisiana State University Press, 1987): 169-207. On the importance of military thought and social change see, Barton C. Hacker, "Military Institutions, Weapons, and Social Change: Toward a New History of Military Technology," Technology and Culture 35 (1994): 826-828.

southern institutions remained "defective." "Thousands of young men in the South," De Bow's lamented, "are out of employment because they are not even qualified for the superintendence of skilled industry." Because of this educational failure, the South lacked railroad superintendents, geologists, chemists, engineers, and machinists. Nevertheless, the journal reported "scientific instruction is being introduced in many of our colleges" due to the technical rigor introduced into southern educational institutions by former members of the Ordnance Department.⁴⁹

Southern educational institutions eventually changed under the influence of former Confederate officers. Mallet taught chemistry at the University of Virginia. Gorgas became president of the University of Alabama. Rains taught chemistry at the University of Georgia. William Leroy Broun, the head of the Richmond Arsenal during the war, pushed through major educational reforms as President of the University of Georgia, the University of Texas, and what would be later known as Auburn University.⁵⁰

They were not alone in their efforts to transform southern universities. General W. M. Browne captured the spirit of progressive education when he told listeners at a convention in Rome, Georgia, that agricultural education had to be taught to a new generation of southerners.

⁴⁹"Education in the South," De Bow's Review 5 (May 1868): 506-514.

⁵⁰Frost, "Confederate Education," 137.

"The force of bad habits," he said, and "the devotion to 'old ways,' the power of prejudice, and the inveterate opposition to theory and book-farming" must be overcome if the South wanted a better future. Rather than education based on the classics, Browne argued, the South would best be served by emphasizing technical and scientific training. He also connected education with modern business practices: "The farmer should understand well the theory; then how when and why the theory should be applied." An educated agriculturist would thereby enforce "the proper order, system, discipline and economy of the business." In addition, an education in civil engineering and chemistry would create a new vanguard of southerners who could build a new, industrialized South. "We should then no longer find it necessary to send to the North or to Europe," Browne asserted, "for engineers to build our railroads or work our mines, for skilled artisans to run our workshops and factories, or for manufacturers to work up our raw material."⁵¹

To realize this dream of a New South, former Confederate officers used West Point and the Virginia Military Institute as models for scientific education. They also promoted the University of Virginia as a progressive educational model. In fact, Broun, Rains, and Gorgas adopted its class elective system at their universities. Virginia's graduates had impressed

⁵¹"Gen. W. M. Browne's Speech at Rome," Southern Farm and Home 2 (December 1870): 46-48.

them as the only group who consistently passed the Ordnance Department's scientific exam during the war. That had convinced them that the elective system was superior to the strict curriculum demanded by classical education.⁵²

In introducing an article by Broun, the editor of De Bow's Review asked rhetorically: "Why are not our young men the superintendents of our railroads. . . . Why do we import geologists, mineralogists, chemists, engineers and machinists?" Because, he answered, the South failed to teach applied science. He offered the French "polytechnic schools" as a model for the solution. Southern educators needed to follow the example of scientific education developed in France, he said, the key to which was the "elective system." By adopting this organization, "education in the South" would present "the highest incentives to industry and economy in the student."⁵³

The editor noted that Broun was an advocate of the elective educational system. He backed this up by pointing out Broun's service as a Confederate Ordnance officer and his scientific expertise. As an ordnance officer during the war, the editor noted Broun had "turned his educated and practical ability to a department of military science" where he "organized and conducted a department for the preparation of fixed ammunition." This position involved a knowledge of chemistry, mechanics, and

⁵²Frost, "Confederate Education," 205.

⁵³"Education in the South," De Bow's Review 5 (May 1868): 506-508.

engineering. The success of the Ordnance Department, the editor argued, proved that the South required an educational system based upon science and technology, and no group was more "competent to speak or more worthy to be listened to on . . . the instruction of Southern youth" than former Confederate ordnance officers.⁵⁴

In the article that followed, Broun stressed the need for educational reform freed from the "restrictive" classical education and which embraced "practical and scientific training." Not surprisingly, he used the Confederate Ordnance Department to illustrate why scientific training proved necessary. The New South required the same expertise exercised by the war's ordnance officers. The "new age" demanded a new education. "No other proof need be offered," Broun wrote, "to demonstrate the necessity of a radical change in our system of collegiate education." Without it, southerners would not be "educated for the age in which they live."⁵⁵

The call for scientific and technical education did not fall on deaf ears. Broun, Gorgas, Mallet, Rains, as well as Robert E. Lee at Washington University, were able to implement educational reform. The University of Georgia established a scientific curriculum based on Broun's ideas. As early as 1866, in fact, the University of Georgia advertised in the Southern

⁵⁴Ibid., 507-508.

⁵⁵W. Leroy Broun, "Improvements Required in Southern Colleges," De Bow's Review 5 (May 1868): 508-518.

Cultivator that it offered a "new feature" to education "in which young men will be carefully and thoroughly trained both in the theory and practice of Civil Engineering." By 1870, the university's high school had strung a telegraph line and was teaching students telegraphy.⁵⁶

Besides Georgia, thirty-five southern schools adopted the elective system. James T. Murfee, a VMI graduate, Confederate veteran, and former commandant of cadets at the University of Alabama, offered the rationale for this new organization. "Under the system of slavery," he said, "ignorance and idleness might acquire and maintain wealth." Under the new economic order, however, the South had to change. "Under free institutions," he wrote, "the individual must depend upon habits of order, system, self-reliance, and a disciplined mind."⁵⁷ Thus, there was a push for a New South education built on engineering, scientific agriculture, and the ideas of system, uniformity, and control. These were the values of a new bureaucratic and organized post-war society. Colonel Robert Beverly, a commencement speaker at in 1877 at an southern agricultural and mechanical college, summed up the necessity for scientific education. "The annihilation of time and space by the inventions of Fulton and Morse," he argued, made it imperative that "the young mind" have "clear insight into

⁵⁶Frost, "Confederate Education," 205-206; Southern Cultivator 24 (October 1866): np.

⁵⁷Quoted in Frost, "Confederate Education," 211.

science" and "complete mastery of principles." Only with such mastery, he insisted, would the South "meet the demands of modern life."⁵⁸

As southerners adapted to "the demands of modern life," many of them realized the economy was undergoing significant organizational change. No longer was theirs a world of planters and yeoman farmers; it was rapidly becoming a world of big business. By means of consolidation, banks, corporations, and railroads were gaining great economic power.⁵⁹ The organization of the southern economy had been dramatically changed by the war, the railroad, and the telegraph. In 1870, southern farmers and planters experienced a very different world than they had in 1860. Therefore, many argued that scientific education and systematic management of farms needed to be coupled with organized power to protect farmers' interests. Although the push for farmers' organizations began in

⁵⁸"Address of Col. Robert Beverley at the Agricultural and Mechanical College Commencement," Southern Planter and Farmer 38 (September 1877): 559-561.

⁵⁹For discussions of the organizational changes taking place during this period see, Robert Wiebe, The Search for Order, 1877-1920 (New York, 1965); Louis Galambos, "Technology, Political Economy and Professionalization: Central Themes of the Organizational Synthesis," Business History Review 57 (4): 471-493; Steven Hahn, The Roots of Southern Populism: Yeoman Farmers and the Transformation of the Georgia Upcountry, 1850-1890 (New York: Oxford University Press, 1983); Jonathan M. Wiener, Social Origins of the New South: Alabama, 1860-1885 (Baton Rouge: Louisiana State University, 1978); Michael Wayne, The Reshaping of Plantation Society: The Natchez District, 1860-1880 (Baton Rouge: Louisiana State University, 1983); and Don H. Doyle, New Men, New Cities, New South: Atlanta, Nashville, Charleston, Mobile, 1860-1910 (Chapel Hill: University of North Carolina, 1990).

the 1850s, the results of the Civil War, the new industrial economy, and the fall of cotton prices intensified interest in these organizational ideas.

The expansion of the railroad and the growth of the national market convinced many southern farmers to organize out of a sense of self-interest. Southerners did not hearken back to a nostalgic Jeffersonian past; rather, they began to adopt the organizational practices employed by large bureaucracies like the railroad. As Edward Ayers has noted, "the nation watched with astonishment as conservative white Southern farmers developed new visions of economics."⁶⁰ Significantly, this new vision included the idea of collected, coordinated action.

In a telling Southern Cultivator editorial in 1867, a southern farmer complained that corporations, bankers, merchants, and railroads controlled the economy. Farmers, he believed, had been left behind. The solution, he argued, was "association." Farmers needed to organize "beginning with neighborhoods, rising to counties, extending to states, and to the nation." With proper organization, farmers could gain "due weight of directing the thought and action of society." In this way, they could combat "hostile associations, and monopolies." This would give farmers a "proper voice in trade, commerce, and legislation." He pointed out that "isolated" and "disassociated" farmers had no power or influence. Indeed, without such

⁶⁰Edward L. Ayers, The Promise of the New South: Life After Reconstruction (New York: Oxford University Press, 1992), x.

organization farmers and planters would remain "the beasts of burden of every corporation and monopoly."⁶¹

An advocate for agricultural clubs agreed. Society was becoming increasingly organized and bureaucratized, and southern farmers had to adapt. "Combination," he wrote, "seems to me to be absolute necessity, almost self-preservation itself." "An individual farmer," had little chance of success "in this age" of bank, industrial, and railroad consolidation. Farmers needed "to combine for a stupendous purpose as a railroad." Otherwise, railroads, merchants, cotton factors, and other "centralizing" groups would run the economy for their own benefit. Farmers had to organize for "mutual protection."⁶²

Many editorialists urged farmers to learn from other professions the importance of organization. "There is a plain road," one wrote, "and that is concert of action." He explained that merchants had their boards of trade, teachers their associations, printers and mechanics their trade unions. "All the trades and professions," he concluded, "have means of securing harmony," while farmers had "no system of concerted effort." Another writer concurred that commercial and manufacturing "capital" possessed

⁶¹"Union of Farmers--Enquiries," Southern Cultivator 25 (August 1867), 246-247.

⁶²"Goodwyn Agricultural Club," Southern Planter and Farmer 32 (July 1871): 387-391; "Farmers' Clubs," Southern Cultivator 26 (July 1868): 220-221.

more "power" than "armies" because of organizational control. A cotton planter explained the predicament in which southern farmers found themselves. "The mechanic, the merchant, the manufacturer and the professional man," he wrote, "fix their own price." Farmers, on the other hand, "must sell . . . at the price attached to his productions by other parties." Cotton planters, he suggested, should therefore "devise a plan that will combine the great body of cotton planters into one great cooperative organization."⁶³

In the South, this organizational mentality gained momentum with the emergence of the Grange, and later, the Farmers' Alliance movement. One editorial writer noted that it could not "be denied that the South has lost much since the war by the want of systematic organization." In response, he encouraged southern farmers to consider a new national organization called the Patrons of Husbandry, otherwise known as the Grange. This organization would "remodel" the agricultural system on several fronts. First, it would give farmers an economic voice. Second, it would give them political clout. Finally, he argued, the Grange would promote scientific agriculture based on chemistry and systematic management. Southern farmers would thereby gain "the best managed

⁶³"The Farmer," The Plantation 3 (July 24, 1872): 469; "An Essay," The Plantation 3 (June 12, 1872): 368;

farms, embracing all the departments of farm economy . . . with the improvements, comforts and profits in proportion to the investment."⁶⁴

Another writer who supported the Grange maintained that "combination and concentration of capital is the spirit of the age." He continued that the "iron--coal--whiskey--tobacco--wool--dairy--and various other interests have their associations for protections." Moreover, railroads, cotton exchanges, and stock exchanges held all the power. "Where is the farmer?" he asked. Two years earlier, in 1871, E. G. Wall, the editor of Field and Factory, gave an address at the Agricultural Fair in Starkville, Mississippi, in which he vented that, unlike farming, "all other professions, trades and mercantile pursuits have their conventions, trade union, and board of trade." Only "the farmer is contented to fight single-handed against all other combinations."⁶⁵

The Grange was founded with a written constitution, membership requirements, and rules and regulations for members, as well as a hierarchy of officers at the national, state, and local level. Farmers joined it for the collective strength it gave them. Far from rebelling against the new economic order, they accepted its new organizational tenets. Much like the

⁶⁴"The South must reorganize and develop her own system of Agriculture," The Plantation 3 (December 1872): 57; "Patrons of Husbandry," Southern Cultivator 31 (May 1873): 164-165.

⁶⁵"Patrons of Husbandry," Southern Cultivator 31 (May 1873): 164-165; "Extracts from an Address by E. G. Wall," The Southern Field and Factory 2 (January 1872): 38.

railroad companies wanted pools to control cut-throat competition, the Grange hoped that cooperation and government action would raise crop prices and lower transportation costs. The Grange also encouraged farmers to use scientific agriculture and support agricultural education. Broun, Mallet, and others supported this campaign and addressed meetings of the Grange. The Grange also set up a cooperative buying network to get cheaper goods. The Patrons of Husbandry accepted the new concepts of corporate business. By 1876, more than a third of the Grange's 758,767 members lived in the former slave states.⁶⁶

Association was widely seen as a solution to the major problems that beset farmers. F. A. Dulany of Camden, Alabama, believed association would bring them "progress and improvement in all the arts and sciences." Another southerner envisioned "an organization in every locality in the South to supply its members with all the necessary improved and labor saving implements, manures, seed, and stock." A writer from Memphis clearly articulated the modern vision of organization, maintaining that by organizing effectively farmers could use technology in their favor. "Owing to the facilities afforded by telegraph and railway," he wrote, "transactions amounting to thousands are frequently negotiated in advance." If southern

⁶⁶Robert C. McMath, Jr., American Populism: A Social History, 1877-1898 (New York: Hill and Wang, 1993), 58-59; Proportion of Grange members derived from Linda Marie Thorstad, "The Historical and Cultural Geography of the Grange in Minnesota and Louisiana, 1870-1880" (Ph.D. diss., Louisiana State University, 1999), 38

planters created a "colossal" organization, he believed they would be able to set prices by selling together. "The cotton planters have the power to form a close union," he argued, "and force the price up." Through coordination and organizational control, he insisted that farmers would be following the same methods as merchants and "other industries."⁶⁷

An organizational mentality developed in the nineteenth-century South. The organizational ideal emerged during the antebellum period and gained momentum during the Civil War. Indeed, the New South emerged out of the organizational lessons of the antebellum period and the Civil War. Progressive southerners preached the virtues of system, organization, and bureaucratic control. Railroad managers spread new ideas about time, technology, and organizational control throughout the South, and southern reformers applied these ideas to agriculture and education. They also created agricultural organizations in an effort to control the market. Southerners learned from the failure of Confederate railroads and the success of the Confederate Ordnance Department that a New South would need bureaucratic and organizational control. Moreover, under the direction of Mallet, Gorgas, Rains, Broun, and others, southern educators reorganized and modernized education on the basis of scientific principles.

⁶⁷"Co-operation Among Farmers," Southern Cultivator 26 (June 1868): 167; "Co-operation Among Agriculturists," Southern Cultivator 31 (February 1873): 55-56.

In the end, railroads, plantations, and the war contributed to the making of a new, organized South.

EPILOGUE

In the late 1880s, a young North Carolina textile plant manager named Sam Patterson wrote his mother letters that captured the economic changes in the New South. He saw a South transformed by manufacturing and railroads. He described a trip to Augusta, Georgia, for a Cotton Exposition. Traveling on the Charlotte, Columbia, & Augusta railroad, he "had a good view of Columbia, Rock Hill, Chester, & Graniteville" where he "saw some large & handsome mills." At the Exposition, he observed "machinery I never in my life saw." He thought it the most "clever set of Exhibitors." While in Augusta, he visited the Sibley Textile mill, which used the old Confederate Powder Works buildings for its manufacturing. "The Sibley," he wrote, "is the largest mill in Augusta, & is a magnificent building on the outside." Inside, the manufacturing plant employed "about 1000 looms & 35160 spindles." The factory had a bureaucratic management hierarchy. The Superintendent made "\$15.00 a day" and the "Overseers" made "a little over \$5.00 pay [a] day."¹ With this transformation of the

¹Sam Patterson, Concord, North Carolina, to Mamma, December 9, 1888, Box 104.4, in Patterson Papers, North Carolina State Archives, Raleigh, North Carolina.

Confederate Powder Works into a textile mill, Patterson saw firsthand the organizational legacies of cotton plantations, railroads, and the Civil War.

Other members of his family, however, noted the contradictions associated with this economic transformation. One, probably a brother, described the building of a new railroad line. "I went over to see the convicts at work," he told his mother. "They are changing the road bed," and "the stockade is not far from here, just across the rail-road." The slave-labor legacy of the antebellum South endured with the convict-labor system of the New South. Another family member, Howard Patterson, noted that yet another railroad passed "200 feet" from his church's sanctuary. "I could not help being struck," he observed, "by the contrast, between the old and the new."² The Patterson family saw the outlines of a New South. Railroads had consolidated and had tied southern trade to northern cities. At the same time, textile mills started to dot the southern landscape. Birmingham, Alabama, emerged as an important center for the steel and iron industry. Other extractive industries such as timber, naval stores, and mining also were in the process of transforming the South.³

²R. S. Patterson, Walnut Cove, North Carolina, to Mamma, August 26, 1888, and Howard Patterson, Salem, North Carolina, to Pard, October 18, 1888, Box 104.4, in Patterson Papers, North Carolina State Archives, Raleigh, North Carolina.

³C. Vann Woodward, Origins of the New South, 1877-1913 (Baton Rouge: Louisiana State University Press, 1951), 107-141; Edward L. Ayers,

As the New South emerged, it also became part of the national economic system. On November 18, 1883, standard time was introduced nation wide. The national railroad system demanded synchronized time. The telegraph, railroads, and industrial production brought system and uniformity to the nation as a whole. The South did not fight this modernization; it embraced it. As early as June 1870, De Bow's Review had argued for standardized time. Modern business practices, it asserted, required "standard clocks" for "railroads," and "banking houses, etc." "The system of controlling" time, the journal continued, "at least our railroad clocks . . . would be conducive to public comfort and safety." Moreover, "the centralization of our leading" businesses demanded a "uniform" system. The telegraph also made this change imperative. "It is not an unreasonable anticipation," the journal foresaw, that "the time of a central point, between the Mississippi and the Atlantic" becomes "one standard." In 1883, system,

The Promise of the New South: Life After Reconstruction (New York: Oxford University Press, 1992), 104-131; See also, David L. Carlton, Mill and Town in South Carolina, 1880-1920 (Louisiana State University Press, 1982); Henry M. McKiven, Iron & Steel: Class, Race, and Community in Birmingham, Alabama, 1875-1920 (Chapel Hill: University of North Carolina Press, 1995); Don H. Doyle, New Men, New Cities, New South: Atlanta, Nashville, Charleston, Mobile, 1860-1910 (Chapel Hill: University of North Carolina Press, 1990).

uniformity, and control changed the nature of time in both the North and the South.⁴

Southern educational reformers also moved on to the national stage. In 1882, John W. Mallet became president of the American Chemical Society. This professional organization comprised part of the new organizational synthesis taking place with the rise of technology and expertise.⁵ It should not be surprising that one of the men who had helped organize the South for war and was a proponent of a New South became a national leader. Professionalization, organization, and technology became the spirit of the age, and Mallet embodied them.

In sum, a New South emerged from the lessons of the past. The organizational ideas associated with antebellum railroads and plantations helped Southerners organize their new economy. Further still, the lessons of war were applied to railroads, as well as educational and agricultural

⁴Mark M. Smith, Mastered by the Clock: Time, Slavery, and Freedom in the American South (Chapel Hill: University of North Carolina Press, 1997), 178; "Uniformity in Railroad Time," De Bow's Review, After the War Series, 7-8 (May-June 1870): 464-467.

⁵Otto Eisenschiml, "John W. Mallet: ACS President in 1882," Chemical and Engineering News 8 January 1951: 110-111; Louis Galambos, "The Emerging Organizational Synthesis in Modern American History," Business History Review 44 (3) (1970): 279-290; Louis Galambos, "Technology, Political Economy and Professionalization: Central Themes of the Organizational Synthesis," Business History Review 57 (4) (1983): 471-493.

reform. A New South, then, was built on the organizational foundations laid by railroads, plantations, and war.

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VITA

Steven Gedson Collins was born at Scott Air Force Base, Illinois, on April 22, 1965. He grew up on several Air Force bases and graduated from Prattville High School, Alabama, in 1983. In May 1987, he completed a bachelor of science degree in business management at Oklahoma State University and was commissioned a Second Lieutenant in the United States Air Force. While on active duty in the Air Force, he flew the T-41 and T-37 aircraft. Upon joining the Air Force Reserves, he entered graduate school at Southwest Texas State University. In 1992, he completed a master's degree in American history at Southwest Texas and was presented the B. R. Brunson Outstanding Thesis Award by the faculty of the History Department. He entered the doctoral program in History at Louisiana State University in the fall of 1992. In 1996-1997, he received the T. Harry Williams Dissertation Fellowship from the Louisiana State University History Department. In 1999, he was hired as a full-time history instructor at St. Louis Community College at Meramec. He expects to earn the degree of Doctor of Philosophy in History in December 1999. Most importantly, he married Ann Victoria Brunson in August 1990.



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System in the South

John W. Mallet, Josiah Gorgas, and Uniform Production at the Confederate Ordnance Department

STEVEN G. COLLINS

When a war is decided upon, it becomes necessary to prepare, not an entire plan of operations,—which is always impossible,—but a system of operations in reference to a prescribed aim; to provide a base, as well as all the material means necessary to guarantee the success of the enterprise.¹

When the South seceded from the Union in 1861, few trained soldiers would have disagreed with Henri Jomini's assessment that war required a "system of operations." It is worth examining, then, why the production of ammunition in the Confederate States Ordnance Department became one of the few bureaucratic bright spots in the Confederacy's dismally organized war effort. By war's end the Confederate government could barely feed and clothe its troops. Ammunition, however, continued to be produced in adequate amounts. Brigadier General Josiah Gorgas, chief of the Ordnance Department, and his subordinate, Lieutenant Colonel John W. Mallet, commander of the Confederate laboratory at Macon, Georgia, enhanced the Confederacy's ability to wage a long and destructive war.² With the appli-

Mr. Collins is a Ph.D. candidate in the Department of History at Louisiana State University. He is completing a dissertation titled "Organizing the South: Railroads, Plantations, and War, 1840-1890." He thanks Paul Paskoff, Gaines Foster, James Pohl, Anthony Gaughan, James Gaughan, the *Technology and Culture* referees, and the editor for their helpful and insightful comments.

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1. Henri Jomini, *The Art of War*, ed. Thomas E. Griess and Jay Luvass, trans. G. H. Mendell and W. P. Craighill (Westport, Conn., 1971), 45.

2. The most important work on the Confederate Ordnance Department remains Frank E. Vandiver, *Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance* (Austin, Tex., 1952). The most significant article on this topic is W. Stanley Hoole, "John W. Mallet and the Confederate Ordnance Laboratories, 1862-1865," *Alabama Review* 26 (1973): 33-72, which focuses on Mallet's visits to the many arsenals and the construction of the laboratory. Another valuable source is Maurice Kaye Melton, "Major Military Industries of the Confederate Government" (Ph.D. diss., Emory University, 1978). For a

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Steven G. Collins

Major Field: History

Title of Dissertation: Organizing the South: Railroads, Plantations, and War

Approved:

Paul F. Penkoff
Major Professor and Chairman

William M. Lockie
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